

TM 11-4029

WAR DEPARTMENT TECHNICAL MANUAL

RADIO RECEIVERS

R-19/TRC-1, R-19A/TRC-1,
R-19B/TRC-1, R-19C/TRC-1,
R-19D/TRC-1, and R-19E/TRC-1

REPAIR INSTRUCTIONS

RADIO RECEIVERS

R-19/TRC-1, R-19A/TRC-1,
R-19B/TRC-1, R-19C/TRC-1,
R-19D/TRC-1, and R-19E/TRC-1

REPAIR INSTRUCTIONS



WAR DEPARTMENT . DECEMBER 1945

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Washington 25, D. C., 10 December 1945

TM 11-4029, Radio Receivers R-19/TRC-1, R-19A/TRC-1, R-19B/TRC-1, R-19C/TRC-1, R-19D/TRC-1, and R-19E/TRC-1, Repair Instructions, is published for the information and guidance of all concerned.

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EDWARD F. WITSELL

Major General

Acting The Adjutant General

DWIGHT D. EISENHOWER

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(3); 11-587 (3); 11-592 (3); 11-597 (3).

Refer to FM 21-6 for explanation of distribution formula.

CONTENTS

SECTION		<i>Paragraph</i>	<i>Page</i>
I.	DESCRIPTION OF RADIO RECEIVERS R-19/TRC-I, R-19A/TRC-I, R-19B/TRC-I, R-19C/TRC-I, R-19D/TRC-I, AND R-19E/TRC-I.		
	General	1	1
	Over-all system function.....	2	2
	Simplified circuit analysis.....	3	6
II.	DIFFERENCES IN MODELS.		
	Design differences	4	8
III.	INITIAL REPAIR PROCEDURES.		
	General	5	9
	Tools, test and cleaning equipment.....	6	9
	Removal of receiver.....	7	9
	Removal of tubes.....	8	10
	Removal of units.....	9	10
	Chassis cleaning, inspecting, and lubricating.....	10	10
	Cleaning, inspecting, and testing of tubes.....	11	10
IV.	PRELIMINARY TROUBLE-SHOOTING PROCEDURES.		
	Input resistance measurements.....	12	11
	Operating test	13	11
V.	ALIGNMENT PROCEDURE.		
	Preliminary preparation and procedure.....	14	12
	Tuning of oscillator, high-frequency i-f, r-f, and antenna stages	15	14
	Tuning of low-frequency, intermediate frequency.....	16	14
	Tuning of first and second limiters.....	17	14
	Tuning of discriminator.....	18	14
	Retuning of antenna stage.....	19	14
	Squelch adjustment	20	14
	Audio level adjustment.....	21	14
VI.	DETAILED TROUBLE-SHOOTING PROCEDURES.		
	General trouble-shooting information.....	22	16
	Localizing trouble to a stage.....	23	19
	Checking audio circuit.....	24	19
	Use of signal tracing analysis chart.....	25	19
	Signal substitution	26	19
	Signal tracing	27	20
	Voltage and resistance measurements.....	28	20
	Moistureproofing, fungiproofing, and refinishing.....	29	21
	Trouble-shooting charts	30	21
	Localizing trouble in Radio Receiver R-19(*)/.....	31	21

	Paragraph	Page
VII. FINAL TESTING.		
General	32	23
Test instruments required.....	33	23
Moving parts and finish.....	34	23
LINE ON OFF switch.....	35	23
A-C LINE voltage test.....	36	23
SPEAKER ON OFF switch and SPEAKER VOLUME control	37	23
AUDIO GAIN control.....	38	23
MULTICHANNEL single filter switch and filter switch..	39	23
SQUELCH ON OFF switch and SQUELCH ADJUST control	40	24
TEST OSC check.....	41	24
Sensitivity and alignment.....	42	24
Receiver output terminals.....	43	24
Sensitivity 20-db quieting.....	44	24
Signal plus noise-to-noise ratio.....	45	25
Squelch sensitivity	46	25
Audio output levels.....	47	25
Over-all audio response.....	48	25
Filter operation	49	26
Level linearity	50	26
Bandwidth test	51	26
Test Oscillator TS-32(*)/TRC-1.....	52	27
 VIII. INDIVIDUAL STAGE AND CIRCUIT REPAIR DATA.		
General	53	29
First r-f amplifier stage (V101).....	54	30
Second r-f amplifier stage (V102).....	55	32
First mixer stage (V103).....	56	34
First i-f (high-frequency) amplifier stage (V104).....	57	36
Second i-f mixer stage (V105).....	58	38
Second i-f (low-frequency) amplifier stage (V106).....	59	40
First limiter stage (V107).....	60	42
Second limiter stage (V108).....	61	44
Discriminator stage (V109).....	62	46
Squelch rectifier stage (V110).....	63	48
Crystal oscillator stage (V111).....	64	50
Oscillator amplifier stage (V112).....	65	52
Audio output and carrier operated relay amplifier stage (V113).....	66	54
Speaker amplifier stage (V114).....	67	56
Squelch and first audio stage (V115).....	68	58
Power rectifier stage (V116 and V117).....	69	60
Meter M101 and switches.....	70	62
Exhaust fan stage.....	71	64
 IX. SUPPLEMENTARY DATA.		
Parts identification.....	72	66
Jumpers	73	66
Parts data	74	67

WARNING

HIGH VOLTAGE

is used in the operation
of this equipment

DEATH ON CONTACT

may result if operating personnel
fail to observe safety precautions.

SECTION I

DESCRIPTION OF RADIO RECEIVERS R-19/TRC-I, R-19A/TRC-I, R-19B/TRC-I, R-19C/TRC-I, R-19D/TRC-I, AND R-19E/TRC-I*

I. General

a. Official nomenclature followed by (*) is used to indicate all models of the equipment included in this Technical Manual. Thus, Radio Receiver R-19(*)/TRC-I represents Radio Receivers R-19/TRC-I, R-19A/TRC-I, R-19B/TRC-I, R-19C/TRC-I, R-19D/TRC-I, and R-19E/TRC-I, which are treated together in this manual. For brevity, equipment indicator letters are omitted. For example, R-19(*)/ is used to represent

R-19(*)/TRC-I, and R-19B/ represents R-19B/TRC-I.

b. ABBREVIATIONS:

f-m	frequency modulated.
kc	kilocycles.
mc	megacycles.
db	decibels.
cps	cycles per second.

*See TM 11-2601 for installation, operation, and other maintenance data on this equipment.

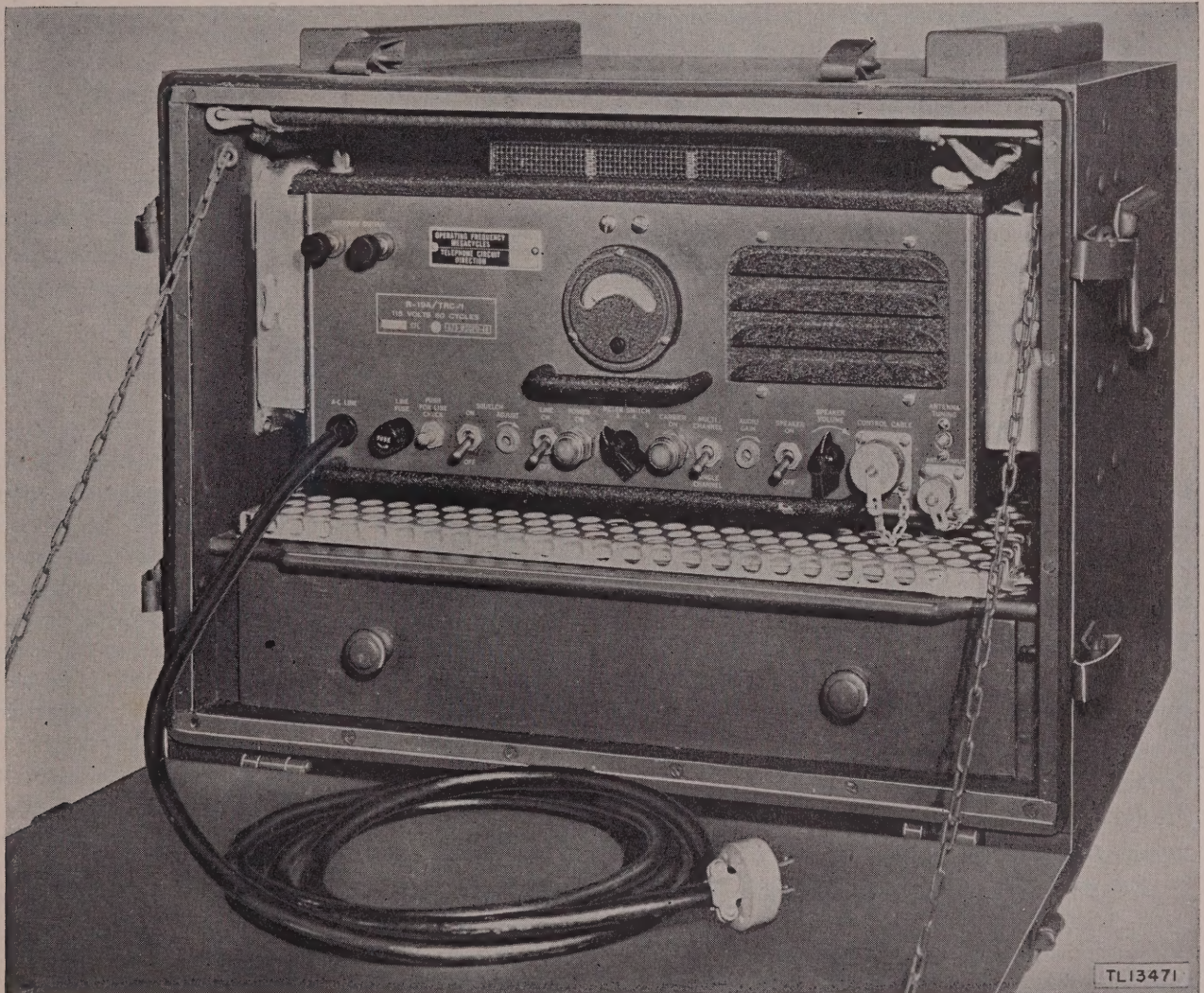


Figure 1. Radio Receiver R-19(*)/.

dbm	zero decibel level equal to 0.001 w in 600 ohms.
v	volts.
w	watts.
ac	alternating current.
r-f	radio frequency.
i-f	intermediate frequency.
mmf	micromicrofarad
mf	microfarad.
vac	volts alternating current.
a-f	audio frequency.
muv	microvolts.

c. Radio Receiver R-19(*)/ is a basic component of Radio Set AN/TRC-1, Radio Terminal Set AN/TRC-3, and Radio Relay Set AN/TRC-4. It is a 17-tube (16-tube in some of the first units), single-channel, crystal-controlled, superheterodyne receiver designed for the reception of frequency-modulated (f-m) signals. A thermostatically controlled fan circulates filtered air through the chassis when the chassis temperature exceeds approximately 75° to 85° F. This makes continuous operation practicable on locations where the surrounding temperature is high under operating conditions. A meter and meter switch are provided on the front panel for convenience in making circuit adjustments. Power is supplied from regular commercial power, when available, or by means of the gasoline-engine-driven alternator, Power Unit PE-75-(*).

d. Technical characteristics of Radio Receiver R-19(*)/ are:

Receiver type	double superheterodyne
Number of tubes.....	17
Type of modulation received	fm (30 kc deviation)
Frequency range	70.0 to 99.9 mc
Preset channels	1
Frequency control.....	Crystal
Crystal frequency range...	7,300 to 8,741.7 kc
Intermediate frequency:	
1st i-f	32.5 to 47.5 mc, variable
2d i-f	5.0 mc, fixed
Sensitivity	5 microvolts at 30% modulation

Audio response:

High fidelity output...	$\pm \frac{1}{2}$ db 200-12,000 cps
Low fidelity output...	$\pm \frac{1}{2}$ db 200-2,500 cps
	-30 db at 3,000 cps and above.

Audio band width:

Single channel	200 to 2,800 cps
Multichannel	200 to 12,000 cps

Output impedance:

High fidelity	500 ohms
Low fidelity	speaker

Output level (500 ohm

line)	0 dbm normal, + 20 dbm max.
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Power input 115 v, 50-60 cycle, ac, 100 w.

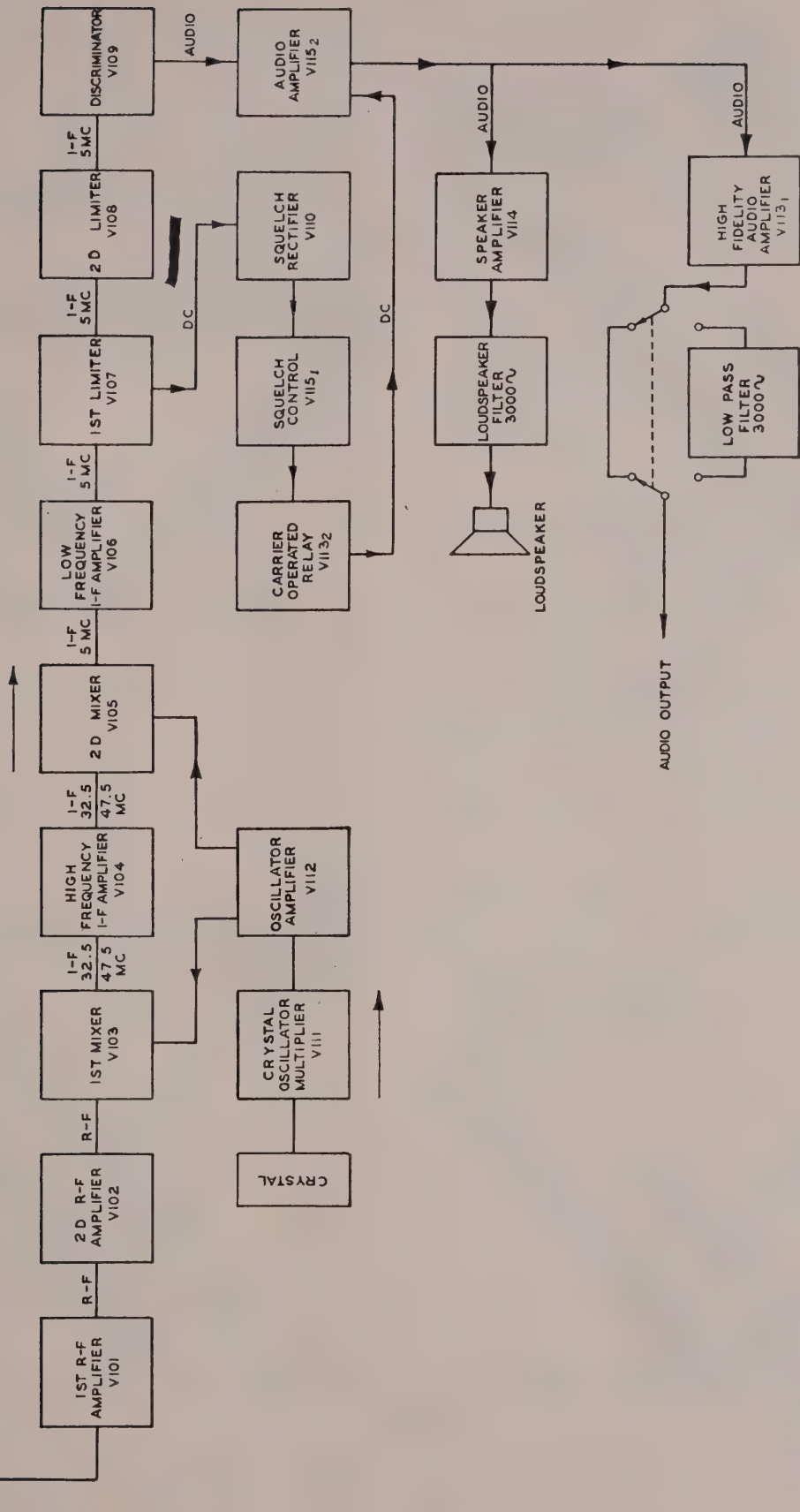
Power output:

High fidelity	10 milliwatts
Low fidelity	1 watt

Antenna half-wave dipole with director and reflector elements; supported by a 40-foot mast.

2. Over-all System Function

a. GENERAL. A study of figure 2 will aid materially in understanding the over-all system function of Radio Receiver R-19(*)/. A double conversion superheterodyne circuit is used to produce an intermediate frequency of 5 mc. A crystal frequency multiplier stage is provided to increase the crystal frequency five times before it is applied to the oscillator. A squelch circuit is included to "squelch" noise when no signal is being received. A carrier operated relay amplifier stage is used to energize a relay (RL101). When this relay is energized a panel lamp lights, indicating that a carrier is being received. A circuit is also completed through the control cable that will energize a relay in the associated transmitter used with this receiver. In other respects, Radio Receiver R-19(*)/ operates in much the same manner as any other conventional f-m receiver. More complete details regarding the functioning of the receiver may be found in TM 11-2601.



TL 14342

Figure 2. Simplified block diagram, Radio Receiver
R-19(*).



Figure 3. Panel controls, Radio Receiver R-19(*).

(1) *A-c line.* Primary power is applied to the receiver at this point.

(2) *Mute on off switch.* When the CARRIER CONTROL switch is in position 1, and the MUTE switch is ON, closing the switch on the handset shorts the speaker of the receiver to ground through antenna relay RL1.

(3) *Receiver output binding posts.* These posts are used in four-wire radio remote control to connect the receiver high output to line 2 of Remote Control Unit AN/TRA-2.

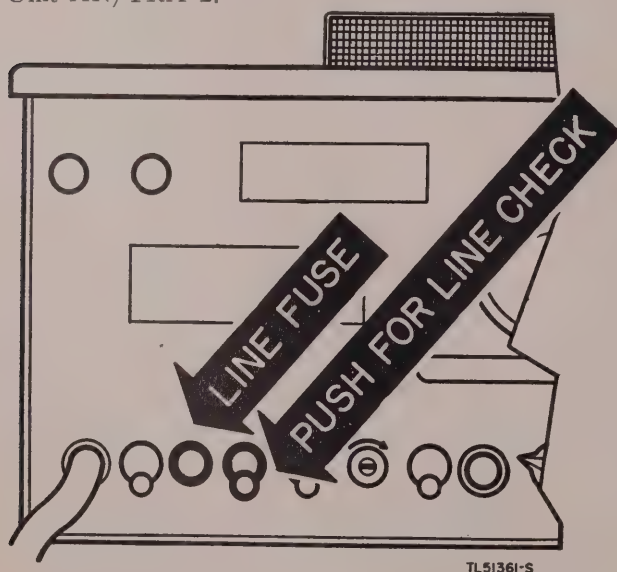


Figure 4. Panel controls, Radio Receiver R-19(*).

(4) *Line fuse.* Serves as protection for various receiver components from damage caused by shorts or excessive overload.

(5) *Push for line check.* Check proper operating line voltage by rotating METER SWITCH to position 6 and pushing the PUSH FOR LINE CHECK switch button.

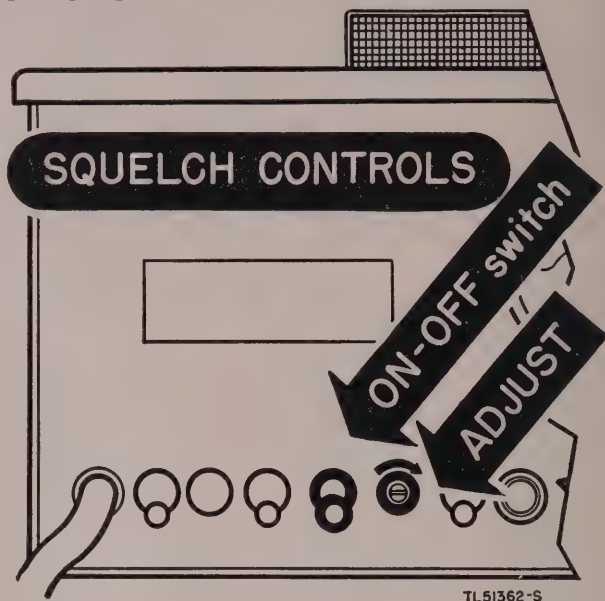


Figure 5. Panel controls, Radio Receiver R-19(*).

(6) *Squelch on off switch.* This switch is used to remove the squelch relay from the circuit when squelch operation is not desired.

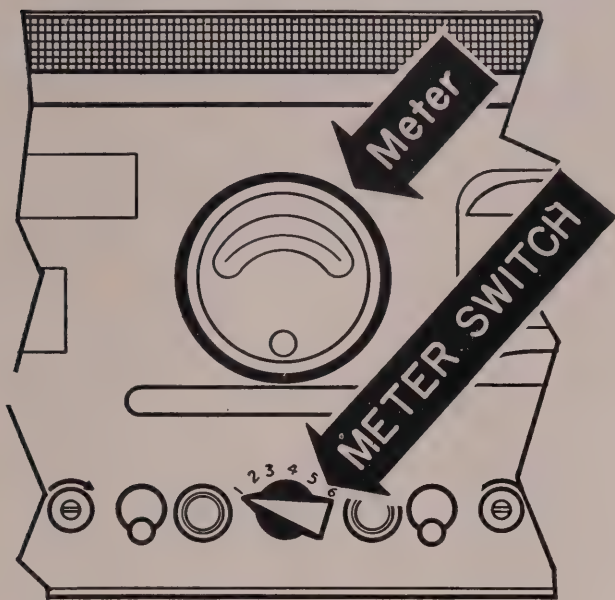
(7) *Squelch adjust control.* This control is used with the SQUELCH ON OFF switch when squelch operation is desired. It is used to vary the sensitivity of the receiver.



Figure 6. Panel controls, Radio Receiver R-19(*).

(8) *Line on off switch.* In the ON position, the line or power switch connects the receiver to the a-c power source.

(9) *Power on lamp.* When power is applied, the POWER ON (green) pilot lamp will light.



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Figure 7. Panel controls, Radio Receiver R-19(*).

(10) *Meter switch.* The six-position meter selector switch S106 connects meter M101 into the various receiver circuits to facilitate tuning and operation of the unit.



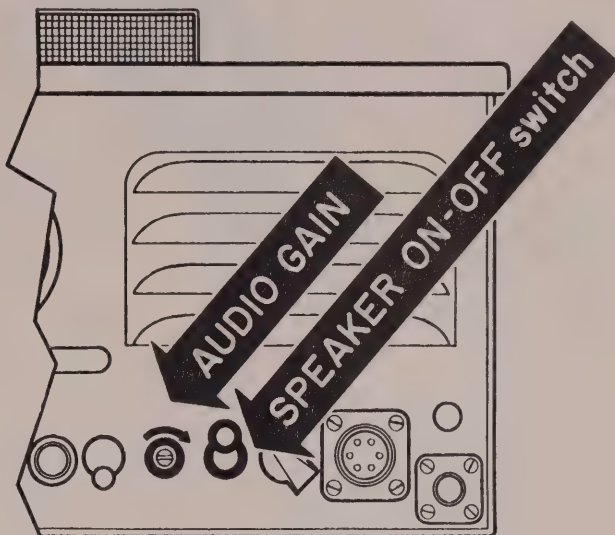
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Figure 8. Panel controls, Radio Receiver R-19(*).

(11) *Carrier on lamp.* The CARRIER ON pilot lamp indicates that a carrier wave is being

received even though no modulation is present on the carrier. It also indicates that the audio section of either the receiver or associated transmitter may be inoperative or that the transmitter is not being modulated.

(12) *Multichannel single switch.* This switch puts a low pass filter T117 into or out of the high fidelity circuit. With switch in SINGLE CHANNEL position, filter T117 is connected into the audio output line and cuts off all audio frequencies above 3,000 cycles.

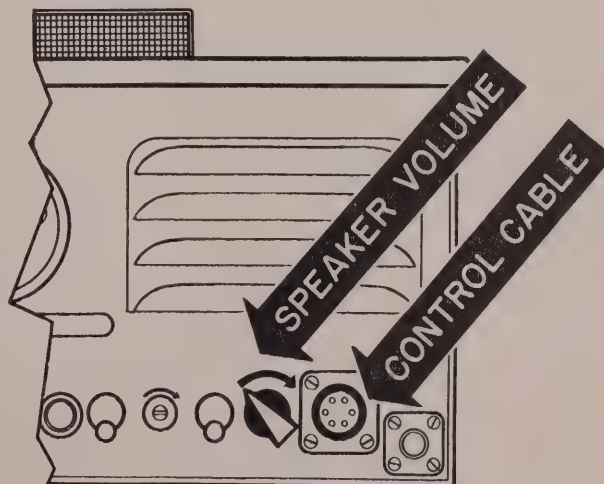


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Figure 9. Panel controls, Radio Receiver R-19(*).

(13) *Audio gain control.* The AUDIO GAIN screw driver control is a potentiometer which adjusts the audio output of the high fidelity circuit.

(14) *Speaker on off switch.* The switch is placed in the ON position to put the loudspeaker into operation.



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Figure 10. Panel controls, Radio Receiver R-19(*).

(15) *Speaker volume control.* This control is a potentiometer which adjusts the audio level to the monitoring speaker (low fidelity circuit).

(16) *Control cable receptacle.* This receptacle engages the plug of Cord CX-104/TRC-I used to interconnect the receiver and its associated transmitter.

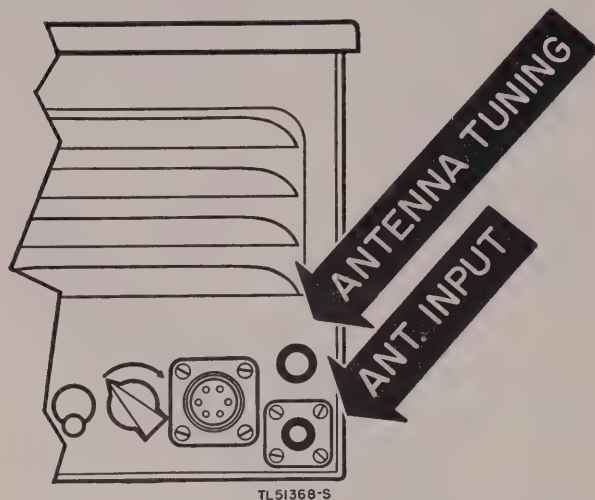


Figure 11. Panel controls, Radio Receiver R-19(*).

(17) *Ant. input receptacle.* This receptacle engages the plug of Cord CD-800 (50-foot) used for connecting the antenna to the receiver.

(18) *Antenna tuning control.* This control is adjusted for maximum meter reading with the METER SWITCH on position 1 or 2.

3. Simplified Circuit Analysis

a. The following tubes are used in Radio Receiver R-19(*).

b. Reference to the schematic diagram of figure 53 will aid materially in following the brief circuit analysis presented here. A conventional r-f input circuit is made resonant to the desired signal. A tuned plate circuit in the first r-f stage (V101) is also resonated to the desired signal. The r-f signal is coupled to the grid of the second r-f stage (V102) through a link coupled tuning transformer. Another tuned plate circuit in the second r-f stage is also resonated to the desired signal. The signal is then coupled to the grid of the first mixer (V103) through a second link coupled tuning transformer. The three tuned circuits and two link coupled tuning transformers provide excellent gain and selectivity in the r-f section.

c. The r-f signal is heterodyned with the oscillator signal at the grid of the first mixer (V103). The tuned plate circuit of V103 selects a high-frequency i-f signal (32.5 to 47.5 mc) and couples it to the grid of the first i-f amplifier (V104). Here the i-f is amplified and coupled to the grid of the second mixer (V105) through a tuned plate circuit and a capacitor.

d. The second mixer stage (V105) heterodynes the first i-f of 32.5 to 47.5 mc with a second output circuit from the oscillator and makes the conversion to a final i-f of 5 mc. The signal is then passed through an i-f stage (V106) to the first and second limiters (V107 and V108) and to the discriminator (V109). The discriminator produces an audio-frequency voltage output derived from the frequency-modulated (i-f) carrier frequency.

Ref. No.	Function	VT No.	Commercial type	JAN No.
V-101	1st r-f amplifier.....	VT-112	6AC7	6AC7
V-102	2d r-f amplifier.....	.....	6SH7	6SH7
V-103	1st mixer.....	.....	6SH7	6SH7
V-104	High-frequency amplifier.....	VT-112	6AC7	6AC7
V-105	2d mixer.....	.....	6SH7	6SH7
V-106	Low-frequency amplifier.....	.....	6SH7	6SH7
V-107	1st limiter.....	.....	6SH7	6SH7
V-108	2d limiter.....	VT-112	6AC7	6AC7
V-109	Discriminator	VT-90	6H6	6H6
V-110	Squelch rectifier.....	VT-90	6H6	6H6
V-111	Crystal oscillator.....	.....	6SH7	6SH7
V-112	Oscillator amplifier.....	.....	6SH7	6SH7
V-113	High fidelity a-f output and carrier operated relay amplifier.....	VT-231	6SN7GT	6SN7GT
V-114	Speaker and headphone monitoring amplifier	VT-107-A	6V6GT/G	6V6GT/G
V-115	1st a-f amplifier and squelch.....	VT-229	6SL7GT	6SL7GT
V-116	Power rectifier.....	VT-126-B	6X5GT/G	6X5GT/G
V-117	Power rectifier.....	VT-126-B	6X5GT/G	6X5GT/G

The discriminator output is amplified by section 2 of stage VII5 and passed through the output stage VII3 to the speaker.

e. The heterodyning frequency is generated by a crystal in the grid circuit of the crystal oscillator multiplier stage (VIII). The output oscillator tank

is tuned to 5 or 6 times the crystal frequency which ranges from 7.3 to 8.74 mc.

f. A more complete and detailed analysis of the functioning of Radio Receiver R-19(*)/ may be found in TM II-2601.

SECTION II

DIFFERENCES IN MODELS

4. Design Differences

a. Radio Receiver R-19/TRC-1 has only 16 instead of 17 tubes listed in the tube chart of paragraph 3*a*. Only one rectifier Tube JAN-6X5GT/G (V116) was used in the original model of this receiver.

b. Radio Receiver R-19A/ and all successive lettered models have an additional rectifier Tube JAN-6x5 (V117) to increase the life of the initial single rectifier tube. MWO SIG 11-2601-2 authorizes this addition to the unlettered model.

c. Radio Receiver R-19B/ and all successive lettered models have the SPEAKER ON OFF switch S105 changed from single-throw switch to a double-throw switch. A 6-ohm, 10-watt resistor R164 has been added across the OFF position as load across

output transformer T113 when the speaker is turned off so that the audio level of the signal in the handset will remain constant as the speaker is switched in or out. A spring-return LINE CHECK toggle switch S105 has been substituted for the previous push-type switch.

d. Radio Receiver R-19C/ is the same as the B model but is procured from a different manufacturer.

e. Radio Receiver R-19D/ has a MUTE ON OFF switch S107 added in the speaker circuit to permit grounding the receiver speaker when the handset press-to-talk switch is depressed.

f. Radio Receiver R-19E/ is the same as the D model but is procured from a different manufacturer.

SECTION III

INITIAL REPAIR PROCEDURES

Note. Before any repairs or adjustments are made, all authorized Modification Work Orders should be applied. See FM 21-6 for list of applicable MWO's.

5. General

Repair personnel should follow the procedure outlined in this manual when repairing and overhauling Radio Receiver R-19(*)/. Repair information in this section and in section IV is presented in the order in which the repairman should actually perform various operations on the equipment in the repair shop. This procedure permits repair of equipment in the shortest time possible, resulting in sensitivity and selectivity comparable to that of new equipment.

6. Tools, Test and Cleaning Equipment

a. TOOLS. The usual radio repairman's assortment of hand tools such as soldering iron, screw drivers, pliers, alignment tools, etc., will suffice for the overhauling of this equipment.

b. CLEANING EQUIPMENT. Solvent, Dry-cleaning should be used for general cleaning purposes. This should be supplemented with the customary

shop cleaning materials and accessories such as compressed air, cloths, pipe cleaners, dental mirrors, paint brushes, sandpaper, and crocus cloth.

c. TEST EQUIPMENT. The following table indicates the test equipment required to follow the procedures outlined in this manual. It should be understood that various repair installations have a varied and nonuniform assortment of test equipment. For this reason an effort has been made here to indicate the type of equipment and the characteristics required rather than designate a specific piece of equipment to be used.

7. Removal of Receiver

Radio Receiver R-19(*)/ may be removed from its shock mounting rack in Carrying Case CY-18/TRC-1 by turning the locking fasteners one-quarter turn counterclockwise and pulling on the handle located in the middle of the front panel. The set will slide forward and may then be slid and lifted out of the carrying case.

Item	Description
Source of 115 volts a-c power.....	To operate equipment.
1-50 mmf, 1-100 mmf and 1-0.01 mf capacitor.....	For use with signal generators in testing.
Tube checker.....	Standard emission type such as in Test Set I-56.
Ohmmeter	1,000 ohms per volt for d-c resistances up to 1 megohm, such as in Test Set I-56.
Output meter.....	With a range up to at least 15 V, such as in Test Set I-56.
Vacuum tube voltmeter.....	For various test measurements. The Voltomyst, Jr. is recommended.
Dummy antenna.....	75-ohm noninductive resistor to put across receiver antenna terminals for testing purposes.
Coaxial Cable CD800 (50-foot).....	For testing purposes.
Coaxial Cable CD800 (40-inch).....	For testing purposes.
Antenna Array AS-20/TRC-1.....	For tuning receiver.
Test Oscillator TS-32/TRC-1.....	For tuning receiver.
Transmitter	For testing purposes such as Radio Transmitter T-14/TRC-1.
Audio signal generator.....	From 60 to 12,000 cps and from zero to 1 volt output.
R-f signal generator.....	F-m generator with a calibrated output of at least 1 volt. Capable of being deviated at least 30 kc. Must generate a carrier of 70 to 100 mc.

8. Removal of Tubes

Remove tubes by rocking them gently and withdrawing them from sockets.

9. Removal of Units

All units in Radio Receiver R-19(*)/ are easily accessible and parts can be removed by loosening screws and holding brackets that hold parts to chassis.

10. Chassis Cleaning, Inspecting, and Lubricating

a. CLEANING. Thorough cleaning of the receiver is necessary to insure optimum performance and to prevent corrosion, rust, and dirt from damaging parts or causing arc-over or low-resistance leakage between high voltage parts and ground. Remove loose dust and dirt with a brush or blower. Remove dirt or grease which adheres to the chassis or parts with a brush or cloth and dry-cleaning solvent (SD). If this is not available and there is no stenciling on set, use alcohol. If set does have stenciling, use a solution of 50 percent alcohol and 50 percent xylol. Remove shield covers from covered parts and clean with a small brush or pipe cleaner and dry-cleaning solvent (SD). Clean tuning capacitor bearings with the same solution. The filters should be inspected regularly and replaced when they appear dirty.

Caution: The use of carbon tetrachloride is to be avoided since this compound will slowly break down in the presence of water or moisture to form small amounts of hydrochloric acid.

b. INSPECTING. After receiver has been thoroughly cleaned, make a visual inspection of parts and wiring for rust, corrosion, loose connections, frayed or burned insulation, loose screws, and burned or charred resistors and coils. Make a thorough

and careful inspection of tube sockets for broken contacts. Check wave-band switches for loose or bent contacts or broken insulation, and terminal boards for broken lugs and signs of burning. Inspect all tuning-dial gears, setscrews, and antenna relay contacts. Inspect fuses on front panels for efficient operation, since they protect against accidental shorts and overloads in the unit.

c. LUBRICATING. (1) Lubricate the tuning capacitor gear drive assembly with Grease, Lubricating, Special. This is a light grease such as Army issue machine-gun grease and is suitable for use at all temperatures at which this receiver is designed to operate.

(2) For other parts requiring an oil lubricant use Oil, Lubricating, Preservative, Special. This oil is similar to commercial high-grade, low-pour-test, oxidation inhibited mineral oil and is suitable for use at all temperatures at which this receiver is designed to operate.

(3) For general information on lubrication, see TB SIG 69.

11. Cleaning, Inspecting, and Testing of Tubes

a. CLEANING. Clean tubes with a cloth moistened with dry-cleaning solvent (SD) and, if necessary, clean grid caps and prongs with crocus cloth.

b. INSPECTING. Inspect tubes for cracks in glass or base and for bent or broken prongs.

c. TESTING. Test tubes for low emission, leakage, and short circuits with a tube tester, or place doubtful tubes in a receiver known to be operating normally. This last method entails replacement of a doubtful tube for a good tube in the other set. Failure of this second set to operate indicates that a defective tube was tested. Test all tubes, since two or more tubes may be defective.

SECTION IV

PRELIMINARY TROUBLE-SHOOTING PROCEDURES

12. Input Resistance Measurements

Troubles within the receiver can often be detected by checking resistance of the filament and high-voltage (h-v) circuits at power-input terminals before applying power to equipment, thereby preventing damage to the equipment. Make the following checks before attempting to place receiver in operation:

- a. Input resistance at A. C. LINE is 25 ohms.
- b. Resistance of h-v secondary is 2,500 ohms.

13. Operating Test

a. PRELIMINARY. Insert all tubes in their proper sockets, making sure that they are fully seated. Select proper Crystal FT-243 for the operating frequency desired and insert it in crystal socket Y101. Attach Antenna AS-20/TRC-1 to receiver

ANTENNA INPUT connector through lengths of coaxial cable. Apply 115-v a-c power to receiver by means of power cord provided, and throw POWER switch S103 to ON. Switch squelch control to OFF (extreme left-hand position of knob).

b. TESTING. (1) Turn set on by rotating volume control in a clockwise position.

(2) Listen for click indicating that set is turned on, followed by a rushing sound indicating that receiver is operating.

(3) Listen for crackling or buzzing noise which indicates arcing of high voltage.

(4) Check receiver for smoke and the odor of burned or overheated parts.

(5) If there are any indications of trouble, the cause should be determined and corrected before any further steps are taken.

SECTION V

ALIGNMENT PROCEDURE

14. Preliminary Preparation and Procedure

a. GENERAL. (1) Remove Receiver R-19(*)/ from its shock mounting rack in Carrying Case CY-18/TRC-1 by turning locking fasteners one-quarter turn counterclockwise and pulling on handle located in middle of front panel. Set will slide forward and may then be slid and lifted out of the carrying case.

(2) Open top cover of receiver cabinet and check to see that tubes are in place.

(3) Select the proper Crystal FT-243 for the operating frequency desired and place it in crystal socket Y101.

(4) Select corresponding Transmitter Crystal FT-241-A for same operating frequency and place it in crystal socket of Test Oscillator TS-32(*)/ TRC-1 which will be used in tuning receiver.

(5) Insert plug of test-oscillator power cord into socket P106 of the receiver, thus energizing filament and plate circuits of Test Oscillator TS-32/ TRC-1 when receiver LINE switch is turned to

ON. Set test-oscillator tuning control to operating frequency to be used.

(6) Apply 115-v a-c power to the receiver by means of the power cord provided, and throw LINE switch S103 to ON. After allowing several minutes for receiver to warm up, proceed with tuning as described in *b* below.

b. PROCEDURE. (1) All tuning controls that must be adjusted each time receiver is tuned to a channel other than that for which it was preset are marked to indicate their approximate settings. Set the tuning controls on the transformers marked T102, T103, T104, T105, T110, and T111 for desired frequency.

(2) A small indicator dial is fastened to the shaft of each tuning capacitor that has to be adjusted over the 70- to 100-mc range. These dials are calibrated at every 5-mc point between 70 and 100 mc. To adjust any of these circuits to a given frequency of operation, rotate dial until corresponding dial marking is opposite the index pointer.

(3) Do *not* adjust T106, T107, T108, and T109 until the tuning procedure has been completed according to directions given in this subparagraph.

(4) With the controls set approximately, throw SQUELCH switch S102 to OFF and rotate SPEAKER VOLUME control R145 for maximum volume. A loud rushing noise should be heard in the loudspeaker. If this noise is not heard, check to see if all vacuum tubes are warm and securely seated in their sockets.

(5) Place METER SWITCH in position 1 (first limiter grid) and connect R-F OUTPUT of Test Oscillator TS-32/TRC-1 to ANTENNA INPUT connector of Radio Receiver R-19(*)/ by means of Cord CD-800 (40-inch). Observe meter and throw CARRIER switch of test oscillator ON.

(6) If tuning controls have all been preset carefully to proper operating frequency as marked on their scales, a slight deviation of the meter will be observed.

(7) If no deflection is observed on the meter

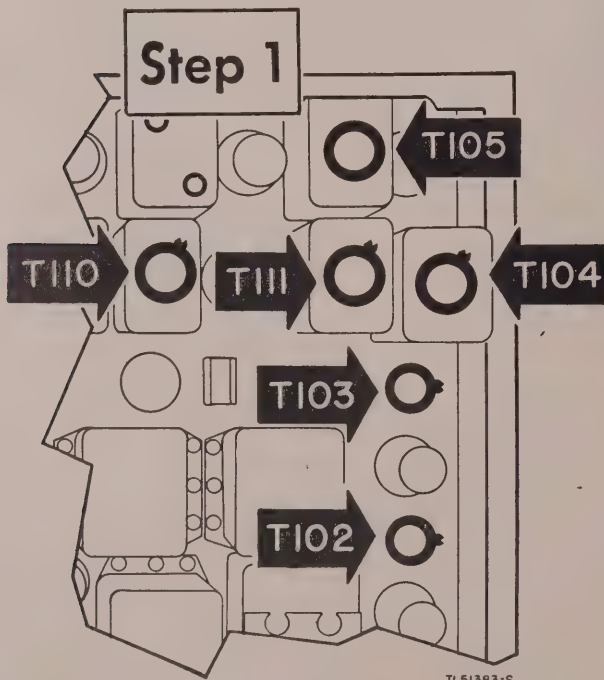


Figure 12. Tuning controls, Radio Receiver R-19(*)/.

when test oscillator CARRIER switch is placed ON, change METER SWITCH to position 3 (second limiter grid) and throw test oscillator CARRIER switch OFF and ON.

(8) Since one more stage of amplification contributes to the second limiter grid current reading, it will show a deflection under conditions of more severe detuning. Keep METER SWITCH in position 1 during the tuning process.

15. Tuning of Oscillator, High-frequency i-f, r-f, and Antenna Stages

a. PREPARATION. Complete tuning of previous stage before proceeding.

b. PROCEDURE. Adjust tuning controls T110, T111, T105, T104, T103, T102, and T101 in the order named, for maximum meter readings. If with METER SWITCH in position 1, the meter reads beyond full scale during tuning procedure, the METER SWITCH may be changed to position 2 giving a meter scale reading approximately one-half as great.

16. Tuning of Low-frequency Intermediate Frequency

a. PREPARATION. Preceding stage must be aligned before proceeding.

b. PROCEDURE. Adjust transformer T106 for maximum meter reading.

17. Tuning of First and Second Limiters

a. PREPARATION. Preceding stages must be aligned before proceeding.

b. PROCEDURE. (1) Adjust T107 for maximum meter reading.

(2) Set METER SWITCH to position 3.

(3) Adjust controls of T108 for maximum second limiter grid current as read on meter.

18. Tuning of Discriminator

a. PREPARATION. Preceding stages must be aligned before proceeding.

b. PROCEDURE. (1) Rotate METER SWITCH to position 4 or 5 (BALANCE), whichever gives a positive reading on test meter. Meter is connected in the same discriminator circuit in either switch position, but the polarity is reversed so that an "up scale" reading may always be had.

(2) Adjust secondary (marked BALANCE) of discriminator transformer T109 for a reading of approximately 10 on the test meter by using insulated alignment tool supplied with equipment.

(3) Adjust primary of discriminator transformer T109 to give a maximum meter reading. Then re-adjust secondary (marked BALANCE) of discriminator transformer T109 for zero reading on the test meter.

(4) During tuning procedure it will be noticed that as receiver is brought into tune, signal from Test Oscillator TS-32/TRC-1 will suppress the rushing noise whenever the oscillator CARRIER switch is ON. At the same time an identifying tone from the oscillator modulator circuit will be heard in loudspeaker if MODULATION switch S402 is ON.

(5) Remove test oscillator power cord and r-f cable. Close receiver cover and place receiver back in its carrying case, making sure to fasten the locking thumbnuts.

19. Retuning of Antenna Stage

a. PREPARATION. (1) Preceding stages must be aligned before proceeding.

(2) Connect antenna transmission line to ANTENNA post on receiver panel.

b. PROCEDURE. As soon as communication is established with the distant station, adjust ANTENNA TUNING control for maximum meter reading with METER SWITCH in position 1 or 2.

20. Squelch Adjustment

a. PREPARATION. Preceding stages must be aligned before proceeding.

b. PROCEDURE. (1) To adjust squelch and carrier-operated relay circuit, throw SQUELCH switch to ON and rotate SQUELCH ADJUST control all the way to the right (clockwise). The adjustment must be made with no signal being received. Under these conditions the characteristic rushing noises should be heard in the loudspeaker and the red CARRIER ON pilot should light.

(2) Rotate SQUELCH ADJUST control back to the left (counterclockwise) until noise stops and CARRIER ON pilot light goes out.

21. Audio Level Adjustment

a. PREPARATION. (1) Preceding stages must be aligned before proceeding.

(2) Turn on audio oscillator and allow it to warm up for a few minutes.

(3) Set up a Radio Transmitter T-14(*)/ which is known to be operating, and tune to receive frequency.

(4) Connect output of audio oscillator to TRSG terminals of transmitter.

b. PROCEDURE. (1) Apply a single-tone input of approximately 1,000 cycles from audio oscillator to Radio Transmitter T-14(*). Input should be applied at a 0- dbm level (0.001 w) with CABLE COMPENSATOR control set at zero. Signal from transmitter is picked up by receiver.

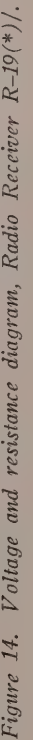
(2) Place receiver METER SWITCH on position 6 (AUDIO LEVEL AND LINE CHECK) and adjust AUDIO GAIN control with a screw driver until test meter reads 0 dbm on the dbm

scale. This adjustment must be made with the normal (500-ohm) line connected to receiver output circuit.

(3) This control operates only on the 500-ohm RECEIVER OUTPUT circuit and has no effect on earphone or loudspeaker levels which are both controlled by SPEAKER VOLUME control. Receiver is now in adjustment for operation.

(4) If at any time during alignment procedure, correct results are not obtained, the cause should be found and reference made to section VIII.

The following trouble-shooting data will prove to



WARNING: BEFORE MEASURING ANY RESISTANCES, REMOVE A-C LINE CORD FROM OUTLET.

VOLTAGE AND RESISTANCE MEASUREMENTS ARE BETWEEN POINTS INDICATED UNLESS OTHERWISE NOTED.

POSITIVE POTENTIALS ARE INDICATED UNLESS OTHERWISE NOTED.

ALL MEASUREMENTS MADE WITH A 1,000-OHM-PER-VOLT METER.

ALL VACUUM TUBES IN THEIR SOCKETS.

100,000 Ω .

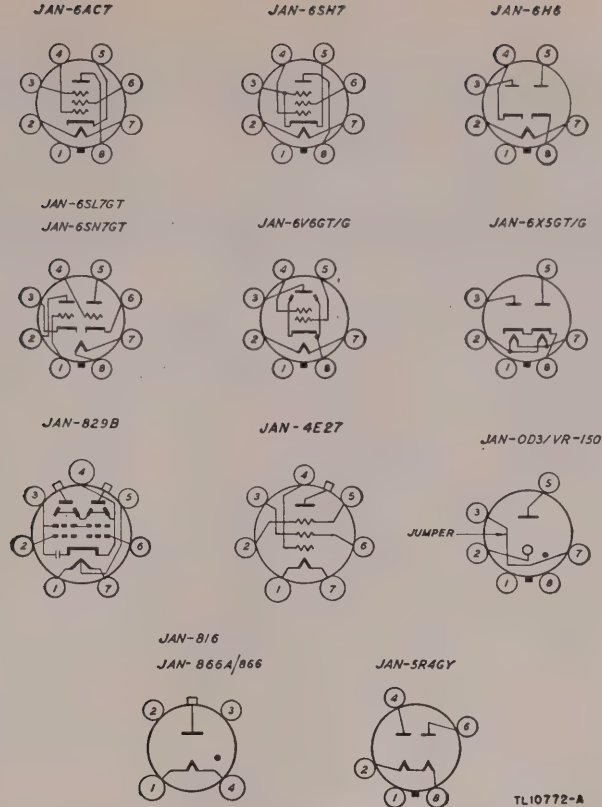


Figure 15. Tube base connections.

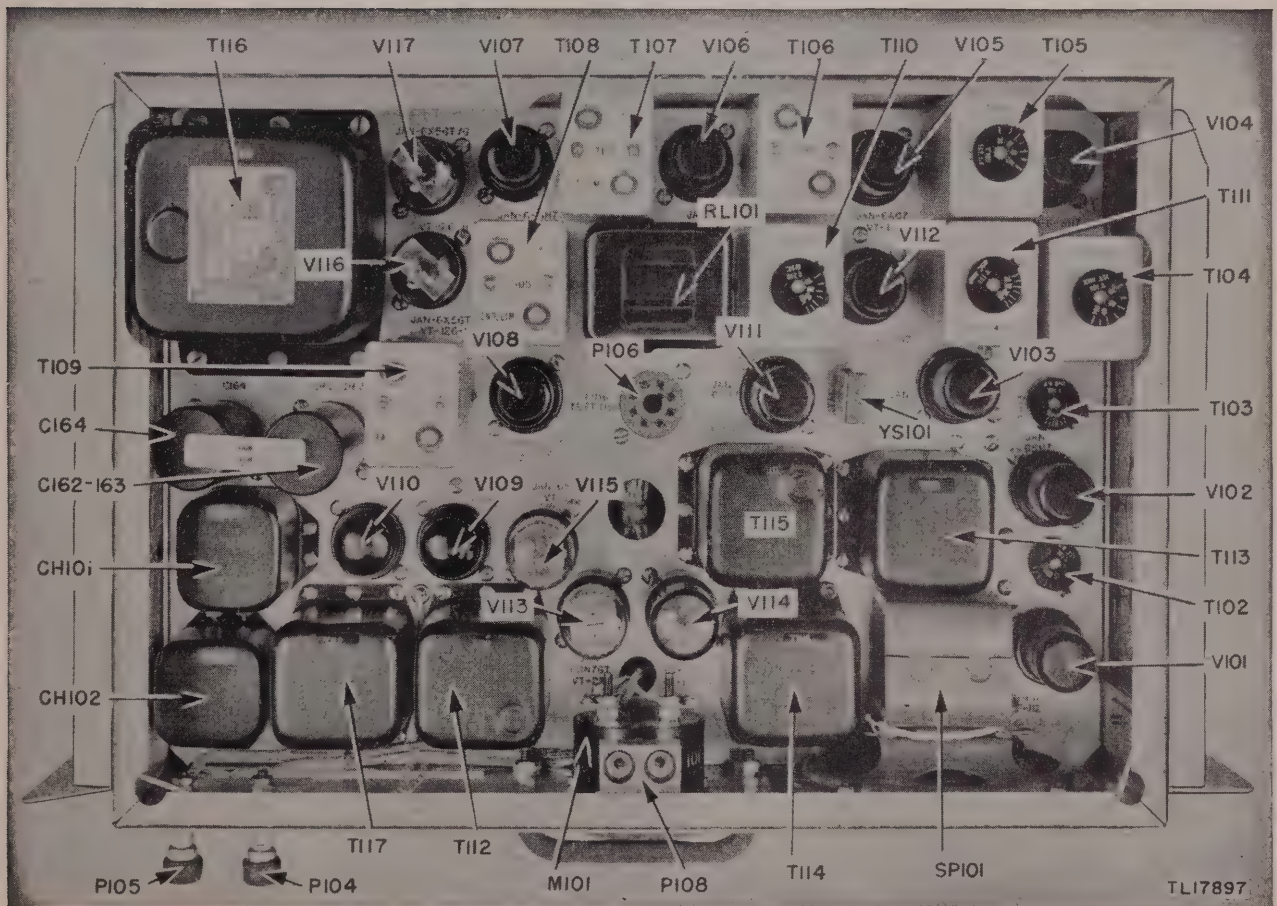


Figure 16. Parts location, top view, Radio Receiver R-19(*).

23. Localizing Trouble to a Stage

When trouble is encountered during the alignment procedure, it can be quickly localized to a particular stage by signal substitution or signal tracing. Frequently, an inoperative stage can be located by circuit disturbance. Turn the set on and after tubes have warmed up, successively touch an insulated screw driver to the control grid of each tube, beginning with output tube and working forward to input tube. If a click or hum is heard in headset or speaker, stage is generally operative. When no response is heard, trouble lies between the point where the click was last heard and the point of no response.

24. Checking Audio Circuit

a. TEST AND INDICATION. (1) Set LINE switch to ON and SQUELCH switch to OFF. Turn SPEAKER VOLUME control to maximum clockwise position (maximum volume). Set SPEAKER ON-OFF switch to ON.

(2) Connect ground lead of audio-signal generator to receiver chassis.

(3) Feed a signal from audio-signal generator, through a 0.01-mf capacitor, to first a-f grid (pin 4 of V115). A loud, clear signal should be heard if the audio circuits are functioning properly.

(4) If a weak signal or no signal is heard, feed

signal from audio-signal generator to output, then to input, of each of the audio stages, beginning with last stage and continuing until defective or inoperative stage is located.

b. LOCALIZATION. If a stage is defective, see paragraph covering stage under test in section VIII. Trace trouble to defective part or parts by resistance and voltage checks.

25. Use of Signal Tracing Analysis Chart

The signal tracing analysis chart lists normal input voltages required at each of the r-f and i-f stages of receiver to produce a signal output of 3 v at the first limiter grid. This chart can be used as a standard when trouble shooting to check over-all gain of receiver, gain of each r-f or i-f stage, or gain of a group of stages. When receiver output is low, localize defective stage by measuring individual stage gain or by checking signal-voltage level of each stage against the chart while using either the signal-substitution or signal-tracing method of trouble shooting.

26. Signal Substitution

a. TEST AND INDICATION. (1) Set LINE switch to ON and SQUELCH switch to OFF. Turn SPEAKER VOLUME control to maximum clockwise position (maximum volume). Set SPEAKER ON-OFF switch to ON.

Table I—Signal tracing analysis chart for signal tracing

Method of input	Input frequency	Signal generator output in microvolts which should produce voltmeter readings shown *	Output measured at	Vacuum tube voltmeter readings
Ant.	98 mc	2	1st r-f grid (pin 4 of V101)	2 muv
Ant.	98 mc	2	2d r-f grid (pin 4 of V102)	20 muv
Ant.	98 mc	2	1st mixer grid (pin 4 of V103)	320 muv
Ant.	98 mc	2	1st i-f grid (pin 4 of V104)	660 muv
Ant.	98 mc	2	mixer grid (pin 4 of V105)	10k muv
Ant.	98 mc	2	2d i-f grid (pin 4 of V106)	375k muv
Ant.	98 mc	2	1st limiter grid (pin 4 of V107)	3 v
Grid (pin 4 of V115)	400 c	0.5	grid (pin 4) of V115	2.75 v
Grid (pin 4 of V115)	400 c	0.5	terminal 4 of T113	14 v *
Grid (pin 4 of V115)	400 c	0.5	receiver output	14 v *

* With audio and speaker gain controls at maximum.

(2) Connect one lead of a vacuum-tube voltmeter to the grid of the first limiter (pin 4 of V107). Connect the other to chassis of receiver (ground).

(3) Using a signal generator with a measured output, feed a signal of the correct frequency for the stage, having a voltage given in the signal tracing analysis chart, to each stage in succession. Begin with the grid of the low-frequency i-f Tube JAN 6SH7 (V106) and work forward to receiver input.

(4) If an output of 3.0 v cannot be obtained when a signal voltage given in the chart is applied to the stage, that stage is defective.

b. LOCALIZATION. If gain of a stage is abnormal, replace tube and realign stage. If gain of that stage is still low, make a resistance and voltage check to locate defective part. To trace trouble to its origin, see resistance and voltage charts and paragraph covering the stage in section VIII.

27. Signal Tracing

a. TEST AND INDICATION. (1) Set LINE switch to ON and SQUELCH switch to OFF. Turn SPEAKER VOLUME CONTROL to maximum

other end of the 50-mm² capacitor, and connect ground lead to receiver chassis.

(4) Adjust signal generator to supply an output signal voltage, of the amplitude listed in the antenna column of the signal tracing analysis chart, for a specific frequency; tune receiver and signal generator to that frequency.

(5) Using a vacuum-tube voltmeter, read input voltage of each r-f and i-f stage in succession, beginning with first r-f tube (V101).

(6) If a stage has an input signal voltage above or below the signal-voltage tolerance given in the chart, the preceding stage is not supplying normal gain.

b. LOCALIZATION. When gain of a stage is abnormal, follow the procedure outlined in section VIII to isolate the defective part.

28. Voltage and Resistance Measurements

Figure 14 supplies correct voltage and resistance measurements made from top of chassis with an adapter and a 1,000 ohm-per-volt voltohmmeter. When no adapter is available, use a short length of insulated wire to make voltage measurements. Strip

Table II—Signal tracing analysis chart for signal substitution

Stage checked	Method of input	Input frequency	Signal generator output in microvolts which should produce V. T. voltmeter readings shown *		Vacuum tube voltmeter at 1st limiter grid (pin 4 of V107)	Gain of
			Normal	Maximum		
Ant.	Antenna	98 mc	2	.....	3v	1
1st r-f	Grid (pin 4 of V101).	98 mc	2	.....	3v	10
2d r-f	Grid (pin 4 of V102).	98 mc	20	.....	3v	16
1st mixer	Grid (pin 4 of V103).	98 mc	320	.....	3v	2
1st i-f	Grid (pin 4 of V104).	.....	560	.....	3v	15
2d mixer	Grid (pin 4 of V105).	.....	10k	.....	3v	37.5
2d i-f	Grid (pin 4 of V106).	5 mc	375k	.....	3v	8
1st audio .....	.....	.....	.....	.....	.....	5.5
Speaker amplifier V114.	.....	.....	.....	.....	.....	4.1
2d audio .....	.....	.....	.....	.....	.....	4.1

* With audio and speaker gain controls at maximum.

clockwise position (maximum volume). Set SPEAKER ON-OFF switch to ON.

(2) Connect one end of a 50-mm² capacitor to the receiver antenna terminal.

(3) Connect signal generator output lead to the

insulation from one lead of the wire and wrap end around pin of tube under test. Insert tube in its proper socket and measure voltage at other end of wire. Avoid shorting wire to chassis. Measure resistance by removing tubes from their sockets.

29. Moistureproofing, Fungiproofing, and Refinishing

a. **MOISTUREPROOFING AND FUNGIPROOFING.** See TB SIG 13 for general instructions.

b. **REFINISHING.** Refinish in accordance with usual shop practices.

30. Trouble-shooting Charts

The procedures presented in this paragraph are intended to supplement the systematic localizing of trouble outlined in paragraphs 23 to 28 inclusive. Often the presence of trouble makes itself known by certain audible or visual symptoms which are peculiar to a specific cause of trouble. In many instances the cause of trouble can and should be found and remedied through the use of the trouble-shooting charts presented here, before proceeding with signal tracing or substitution.

a. If the receiver fails to operate within 1 minute after switch S103 has been turned on, see whether the tubes show signs of heating. If they remain cold, check fuse F101 in fuse holder FS101. If the fuse shows no signs of being blown, check it with a continuity meter to make sure that it is not defective, or replace it with a spare fuse.

b. If, when the receiver is turned on and the SQUELCH switch is OFF, a loud rushing sound

is heard from the loudspeaker or headphones, the receiver may be operating normally, but the tuning may be at fault. Check to see that the tuning controls are in the proper positions and check the receiver tuning.

c. If the receiver fails to make the loud rushing noise described above, check the tubes to see if any are burned out. Replace any tubes which seem defective. The tubes should be checked first when the receiver fails to operate, since they are the most fragile parts of radio equipment and most likely to wear out.

d. Location of trouble in the receiver is made more difficult because the individual r-f stages are not all metered. Any one of the stages V101 through V107, V111, and V112 could be responsible for an improper reading on the tuning meter in METER SWITCH position 1 or 2. If trouble develops in any one of these stages, and defective tubes or misalignment are not the cause, each stage will have to be given an individual resistance and voltage check and the readings checked against the voltage and resistance charts.

e. When trouble shooting, the settings of tuned circuits T106, T107, T108, and T109 should not be tampered with except as a last resort, unless there is a definite sign of trouble in those particular stages.

31. Localizing Trouble in Radio Receiver R-19(*)/

Symptoms	Probable trouble	Corrections
1. Line fuse F101 blown	1. Shorted filter capacitors C162, C163, and C164. Short circuit in fan motor circuit. Short circuit in plate, screen, or filament circuit of any tube. Defective rectifier tubes V116 and V117.	1. Replace. Replace. Replace. Replace.
2. No plate or filament voltage.	2. Line fuse F101 blown. Poor contact of a-c line plug. Defective line switch S103. Defective power cord.	2. Replace. Repair. Replace. Repair.
3. No filament voltage (plate voltage normal).	3. Open lead in filament circuit.	3. Repair.
4. No plate voltage (fuse not blown).	4. Open circuit in power supply. Defective rectifier tubes V116 and V117.	4. Repair. Replace.
5. High hum level in output.	5. Defective filter chokes, CH101, CH102. Defective filter capacitors C162, C163, and C164. Defective hum filters C165 and C166. Receiver output terminal P104 or P105 grounded.	5. Replace. Replace. Replace. Repair.

Symptoms	Probable trouble	Corrections
6. Low or no first limiter grid current (positions 1 and 2 on METER SWITCH).	6. No r-f input at ANT. INPUT connector P101. Defective crystal. Crystal makes poor contact in crystal socket. Wrong crystal for frequency being received. Squelch control setting incorrect. Defective meter.	6. Check antenna input Cord CD-800 (50-foot). Replace. Clean contacts, and replace crystal in socket. Place correct crystal in socket. Check setting of SQUELCH. Replace.
7. Low or no second limiter grid current (position 3 on METER SWITCH), first limiter reading normal.	7. Defective second limiter stage (transformer T108, plate circuit of V107, and circuits of tube V108). Defective meter.	7. Replace. Replace.
8. Discriminator will not balance (positions 4 and 5 on METER SWITCH) first and second limiter stages normal.	8. Discriminator stage defective (plate circuit of V108, discriminator transformer T109, and circuits of V109). Defective meter.	8. Replace. Replace.
9. Low or no audio output in speaker.	9. SPEAKER switch S101 OFF. Defective speaker. Defective SPEAKER VOLUME control R145. Defective audio transformer T113 or T115. Defective filter T114. SQUELCH ADJUST control R153 incorrectly set.	9. Turn switch ON. Replace. Replace. Replace. Replace. Reset.
10. Speaker output distorted.	10. Speaker cone damaged. Discriminator tuning incorrect.	10. Replace. Retune.
11. Audio output at RECEIVER OUTPUT terminals distorted.	11. Terminal P104 or P105 grounded.	11. Replace.
12. Squelch inoperative.	12. Discriminator detuned. Squelch relay defective. Defective SQUELCH switch S102. Defective SQUELCH ADJUST control R153. Receiver sensitivity low. No r-f input at ANT. INPUT connector.	Retune. Repair. Replace. Replace. Check alignment and tubes. Check antenna.
13. Erratic noise in audio output.	13. Oscillation in set (defective bypass capacitors, or improper tuning). Interference from other radio sets. Intermittent contact in the receiver (bad tube, loose connections).	13. Replace capacitor or retune. Check interference charts. (See figs. 42 to 50 incl.) Repair.
14. Low or no audio output at RECEIVER OUTPUT terminals.	14. SQUELCH ADJUST control incorrectly set. AUDIO GAIN control turned down. Defective AUDIO GAIN control R143. Channel switch S104 in SINGLE CHANNEL position. Defective channel switch S104. No output from discriminator.	14. Reset. Rotate AUDIO GAIN clockwise. Replace. Reset switch. Replace. Check discriminator.
15. No audio output reading on db meter (position 6 of METER SWITCH).	15. No audio output at RECEIVER OUTPUT terminals. Meter rectifier RE101 defective. Defective meter.	15. Check tube V113. Replace. Replace.

SECTION VII

FINAL TESTING

32. General

This section is intended for use by Signal Corps radio repair organizations in determining the quality of a repaired Radio Receiver R-19(*). Radio equipment which passes the tests outlined below is suitable for field operation.

33. Test Instruments Required

The instruments required for testing are:

- Oscilloscope.
- Signal generator (5 to 175 mc, 0 to 10,000 v).
- Audio oscillator (15 to 20,000 cps).
- Output power meter (0 to 5,000 milliwatts, -10 to +37 db, 2.5 to 2,000,000 ohms).
- Ohmmeter (0 to 10 megohms).
- Voltmeter (0 to 100 volts direct current, 0 to 52 db).
- Voltmeter (0 to 10 volts alternating current).
- Continuity tester.
- Break-down tester.

34. Moving Parts and Finish

Check the receiver for smoothness of operation in moving or rotating parts and for condition of the finish.

- a. Check the radio set for cleanliness inside and outside.
- b. Rotate all tuning and volume controls. Operation across the arc of rotation should be smooth. There should be no appreciable backlash or slipping of controls.
- c. Try all switches, both rotary and toggle. They should snap firmly into each contact position.
- d. Insert the plugs into the proper jacks. The plugs should seat firmly and make good contact.
- e. Check the fuse holders to see that fuses may be removed easily, but will lock tightly when inserted.
- f. Observe the condition of the finish and plating. Both paint and plating should be free from corrosion, blisters, flaking, bare or worn spots, or deep scratches.

35. Line On Off Switch

- a. Connect the A-C LINE cable to a 115-volt, 50- to 60-cycle a-c power source.

- b. Set the LINE ON OFF switch to ON.

(1) POWER ON pilot lamp on panel (green) should light.

(2) Filaments of the tubes in the chassis must light.

- c. Set LINE switch to OFF.

(1) POWER ON pilot lamp (green) must go out.

- (2) Filaments must go out.

- d. Set the LINE ON OFF switch to ON.

36. A-c Line Voltage Test

- a. Set the METER SWITCH to position 6
- b. Depress and hold down the PUSH FOR LINE CHECK button. The meter needle should stop at the red line (115 volts +5 percent of full scale).
- c. Release PUSH FOR LINE CHECK button. The meter indication should be zero.

37. Speaker On Off Switch and Speaker Volume Control

- a. Set the SPEAKER switch to ON. Noise should be heard in the speaker.
- b. Set the SPEAKER switch to OFF. There should be no noise heard in the speaker.
- c. Set the SPEAKER switch to ON.
- d. Slowly rotate the SPEAKER VOLUME control fully clockwise and then counterclockwise. The noise volume should gradually increase to maximum and then gradually decrease.

38. Audio Gain Control

- a. Set the METER SWITCH to position 6.
- b. Rotate the AUDIO GAIN control fully clockwise and then counterclockwise.
- c. The meter needle should deflect smoothly and evenly over the full scale, in same direction as rotation of control.

39. Multichannel Single Filter Switch and Filter Switch

- a. Set the filter switch to MULTICHANNEL.
- b. Set the METER SWITCH to position 6.

c. Rotate the AUDIO GAIN control until zero indication appears on the db scale of the meter.

d. Set the filter switch to SINGLE CHANNEL. The indication on the db scale must be between -8 and -10 .

40. Squelch On Off Switch and Squelch Adjust Control

a. Set the SQUELCH switch to OFF. The CARRIER ON (red) must light.

b. Set the SQUELCH switch to ON. The CARRIER ON pilot light must go out.

c. Set the SQUELCH switch to OFF.

d. Slowly rotate the SQUELCH ADJUST control clockwise. The CARRIER ON pilot lamp should gradually dim and then go out.

e. Rotate the SQUELCH ADJUST control counterclockwise. The CARRIER ON pilot lamp should appear and gradually increase in intensity to full brightness.

41. Test Osc Check

a. Connect the d-c voltmeter between the chassis frame and pin 4 of the TEST OSC socket. (Socket pin numbers are located by counting counterclockwise from the guide.) Plate voltage indication should be $220 \text{ volts} \pm 9.5$.

b. Connect a-c voltmeter between chassis frame and pin 7 of the TEST OSC socket. Filament voltage indication should be $6 \text{ volts} \pm 0.6$.

c. Connect the ohmmeter between the chassis frame and pin 1 of the TEST OSC socket. Resistance indication should be at least 10 megohms.

42. Sensitivity and Alignment

a. Connect the signal generator antenna to the receiver ANT. INPUT socket.

b. Set the receiver METER SWITCH to position 1.

c. Set the signal generator modulation frequency to 1,000 cycles.

d. Set the signal generator to the frequency marked on the crystal used in receiver.

e. Set the signal generator output to 100 μv .

f. Adjust the signal generator voltage output until 1.0 volt is indicated on the receiver meter.

g. Set the receiver SPEAKER ON OFF switch to ON.

h. Rotate the receiver SPEAKER VOLUME control clockwise until a signal is heard.

i. If no signal is heard, adjust the frequency control dial of the signal generator until the signal is heard.

j. Set the receiver METER SWITCH to position 4.

k. Rotate the signal generator frequency dial until the receiver meter needle returns to zero.

l. Set the receiver METER SWITCH to position 1.

m. Rotate T110-OSC adjustment (on top of the receiver) until maximum deflection is indicated on receiver meter.

n. Set the METER SWITCH to position 4.

o. Adjust the signal generator frequency dial until zero is indicated to the receiver meter.

p. Repeat steps indicated in m, n, and o above, on each of the following controls in order stated:

T111 OSC. AMP

T105 1ST I-F

T104 1ST MIX

T103 2D R-F

T102 1ST R-F

ANTENNA TUNING.

q. Adjust the signal generator voltage output to 5 μv .

r. Set the receiver METER SWITCH in turn to each of the positions listed in table III. Meter indications should be the same as shown opposite the METER SWITCH positions in the table.

Table III

Meter switch positions	Panel meter indications
1	50 to 100.
2	One half of actual indication obtained at meter position 1. $\pm 10\%$.
3	30 to 60.
4	0.
5	0.

43. Receiver Output Terminals

a. Connect the power output meter leads to the RECEIVER OUTPUT terminals. The meter needle should deflect.

b. Connect the leads from the oscilloscope to the RECEIVER OUTPUT terminals. A waveform should appear on the oscilloscope, corresponding to signal generator modulation waveform.

44. Sensitivity 20-db Quieting

a. Connect the 500-ohm resistor across the RECEIVER OUTPUT terminals.

b. Rotate the receiver AUDIO GAIN control fully clockwise.

c. Set the receiver SQUELCH switch to OFF.

d. Set the receiver filter switch to MULTI-CHANNEL.

e. Set the signal generator output to 2 muv with no modulation. Note db indication on the power output meter.

f. Reduce the signal generator voltage to zero. Note the db indication on the power output meter.

g. Difference in readings between steps described in *f* and *e* above should be at least 20 db.

45. Signal Plus Noise-to-noise Ratio

a. Set the signal generator voltage output to 5 muv.

b. Set the signal generator modulation to 1,000 cycles, 30 percent. Note the db indication on the power output meter for use in step indicated in *d* below.

c. Turn off the signal generator modulation. Note the db indication on the power output meter for use in step indicated in *d* below.

d. The difference between the two power output meter indications in steps described in *b* and *c* above is the signal plus noise-to-noise ratio. This ratio should not be less than 25 db.

46. Squelch Sensitivity

a. Set the signal generator r-f output to 0.

b. Set the SQUELCH ON OFF switch to ON.

c. Rotate the SQUELCH ADJUST control gradually counterclockwise from the extreme clockwise position until a rushing noise in the receiver speaker is completely quieted. The CARRIER ON pilot lamp (red) should go out.

d. Gradually increase the r-f output of the signal generator until the squelch relay releases.

(1) The CARRIER ON pilot lamp (red) should light.

(2) A rushing noise should again be heard in the receiver speaker.

(3) The signal generator voltage output should then be not more than 2 muv.

e. Rotate the SQUELCH ADJUST control to the extreme clockwise position.

(1) The receiver rushing noise should be quieted.

(2) The CARRIER ON pilot lamp (red) should go out.

f. Increase the signal generator r-f output until the squelch relay releases.

(1) The CARRIER ON pilot lamp (red) should light.

(2) A rushing noise should again be heard in the receiver speaker.

(3) The signal generator output must be between 500 and 2,500 muv.

47. Audio Output Levels

a. Connect the output meter to the RECEIVER OUTPUT terminals.

b. Connect the signal generator antenna to the receiver ANT. INPUT socket.

c. Tune the signal generator to the same frequency as the receiver.

d. Adjust the signal generator output to 5 muv, 1,000 cps, modulation 30 percent.

e. Adjust the output meter impedance to 500 ohms.

f. Set the AUDIO GAIN control to maximum. The output meter indication should not be less than 18 db.

g. Connect the output meter between pin *E* on the control cable socket and ground.

h. Set the output meter impedance to 1,000 ohms.

i. Set the SPEAKER switch to ON.

j. Turn the SPEAKER VOLUME control to maximum. The output meter indication must be not less than 0 db.

k. Connect the output meter across the loud-speaker terminals.

l. Adjust the output meter impedance to 3 ohms. The output meter indication must be not less than 20 db.

48. Over-all Audio Response

a. ARRANGEMENT OF EQUIPMENT. (1) Connect a 500-ohm resistor across the TRSG. terminals of Radio Transmitter T-14(*).

(2) Connect the audio oscillator across the transmitter TRSG. terminals, in series with the 2,000-ohm resistor.

(3) Connect 500-ohm resistor across the RECEIVER OUTPUT terminals.

(4) Connect the output meter across the transmitter TRSG. terminals.

(5) Connect the oscilloscope across the RECEIVER OUTPUT terminals.

(6) Align the transmitter to the same frequency as the receiver under test.

(7) Operate the transmitter, unloaded, on low power.

b. PROCEDURE. (1) Turn the transmitter CABLE COMPENSATION control to 0.

(2) Set the transmitting CARRIER CONTROL switch to position 4.

(3) Set the receiver filter switch to MULTI-CHANNEL.

(4) Tune the receiver under test to the same frequency as the transmitter.

(5) Set the receiver SPEAKER SWITCH to ON.

(6) Turn the receiver SPEAKER VOLUME control until moderate volume is obtained on receiver speaker.

(7) Set the receiver METER SWITCH to position 2. The receiver meter indication must be not less than 60.

(8) Set the receiver METER SWITCH to positions 4 and 5 in turn. The receiver discriminator must be balanced, indicated by 0 indication on receiver meter.

(9) Set the METER SWITCH to position 6.

(10) Tune the audio oscillator to 1,000 cycles.

(11) Adjust the oscilloscope to obtain a clear sine-wave pattern on the screen.

(12) Adjust the audio oscillator gain control to obtain -8 db. The receiver meter indication must be 0 db.

Note. Zero db for the output meter is a reference level based on 6 milliwatts across 600 ohms. Zero db for the receiver meter is a reference level based on 1 milliwatt across 500 ohms. Zero db indication on the receiver meter corresponds to -8 db on output meter.

(13) Tune the audio oscillator to 250 cycles.

(14) Adjust the audio oscillator gain control to obtain -8 db on output meter.

(a) The negative receiver meter indication must be not more than 2 db.

(b) The oscilloscope pattern must be not more than 15 percent distorted.

(15) Tune the audio oscillator to 5,000 and 12,000 cps in turn.

(16) Adjust the audio oscillator gain control to obtain -8 db on the output meter.

(a) The receiver meter indications must be not more than ± 1 db.

(b) The oscilloscope pattern must be not more than 15 percent distorted.

49. Filter Operation

a. Perform the over-all audio response test before the filter operation test.

b. Gradually increase the audio oscillator frequency from 1,000 cps, at the same time adjusting the audio oscillator output to give -8 db output meter indication. Continue these adjustments until the receiver meter indication decreases abruptly.

(1) The receiver meter must indicate not more than 1 division above 0 on the microamperes scale. (Equivalent to -30 db decrease in output.)

(2) The audio oscillator frequency setting must be not more than 3,200 cps.

(3) The oscilloscope pattern must be a straight, horizontal line.

50. Level Linearity

a. Arrange the equipment as described in paragraph 48.

b. Tune the audio oscillator to 1,000 cps.

c. Set the receiver METER SWITCH to position 6.

d. Adjust the audio-oscillator gain control to obtain a -8-db indication on the receiver meter. Note the receiver meter indication for use in step described in e below.

e. Rotate the transmitter CABLE COMPENSATOR control one step at a time, from positions 1 to 12.

(1) The receiver meter indication must increase 1 db for each change in the transmitter CABLE COMPENSATOR control setting.

(2) The final receiver meter indication must be $4 \text{ db} \pm \frac{1}{2}$.

51. Bandwidth Test

a. Disconnect the signal generator from the receiver ANT. INPUT socket.

b. Insert the signal generator positive lead prod into pin 4 of socket V105 (second mixer tube).

c. Clip the signal generator negative lead to the chassis frame.

d. Set the receiver METER SWITCH to position 4.

e. Tune the signal generator to 5 mc. The receiver meter should indicate 0 microamperes.

f. Set the receiver METER SWITCH to position 5. The receiver meter should indicate 0 microamperes.

g. Set the receiver METER SWITCH to position 1.

h. Adjust the signal generator r-f voltage control dial until the receiver meter indicates 60 microamperes.

i. Set the signal generator output to twice the voltage indicated on the signal output meter.

j. Adjust the signal generator frequency dial until the receiver meter again indicates 60 microamperes. Note the signal generator frequency dial indication for use in step *l* below.

k. Turn the signal generator frequency dial until the receiver meter needle deflects and then returns to 60. Note the signal generator frequency dial indication for use in step *l* below.

l. Obtain the difference between indications noted in steps described in *j* and *k* above and multiply the result by 2. This is the bandwidth in kc. Bandwidth must be 80 kc minimum.

52. Test Oscillator TS-32(*)/TRC-1

a. Arrange Radio Receiver R-19(*)/ for operation at 70 mc. Use a 70-mc receiving crystal.

b. Connect the plug of test oscillator cable PC-401 to the receiver TEST OSC socket.

c. Connect the coaxial cable from the oscillator R-F OUTPUT socket to the receiver ANT. INPUT socket.

d. Insert a 70-mc transmitting crystal in the oscillator crystal socket.

e. Set the oscillator CARRIER and MODULATION switches to ON.

f. Set the receiver METER SWITCH to position 1.

g. Adjust the oscillator TUNING control until the receiver meter indicates maximum.

h. If the meter needle goes off scale, set the receiver METER switch at position 2.

i. Continue adjusting the oscillator TUNING control until the receiver meter indication is maximum. A clear distinct tone should be heard in the receiver speaker.

j. Repeat the test with the receiver and oscillator tuned to 100 mc, using 100-mc receiving and transmitting crystals.

SECTION VIII

INDIVIDUAL STAGE AND CIRCUIT REPAIR DATA

53. General

a. The material in this section is intended as an aid to the repairman in localizing trouble to component parts of individual stages. A separate schematic diagram is given for each individual stage. Individual stage parts lists are presented as an aid and timesaver to the repairman in finding and replacing faulty parts.

b. In some instances, a value shown on a diagram will not correspond to the value in the parts list. This is due to the fact that a stock standardization program has eliminated some parts thus requiring suitable substitutes. The values shown on schematics are ideal and correct. The values and stock

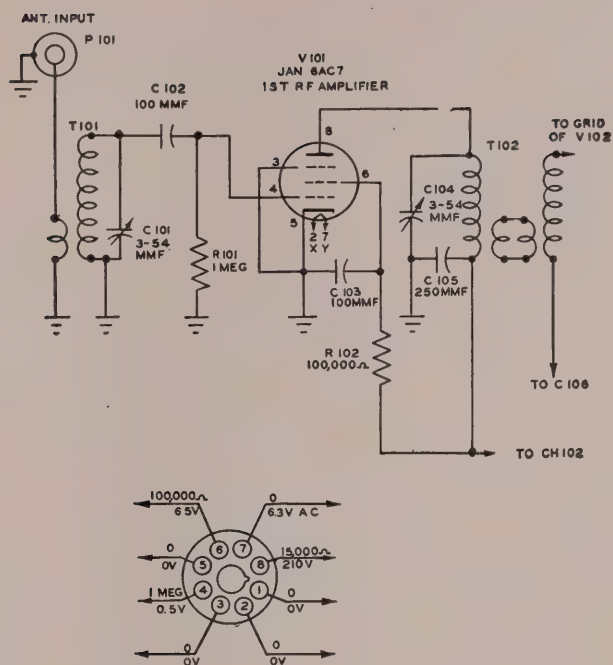
numbers of the parts lists are considered suitable substitutes when one is required.

c. To avoid confusion on a schematic, only one value is given for a particular part. All changes in parts that have been caused by design changes will be readily and more completely understood by checking the parts list for a particular stage. All changes are indicated on the parts list in a column provided for that purpose.

d. No distinction has been made between the unlettered model and the A model because no differences exist except for the addition of a power rectifier tube in the A model.

54. First r-f Amplifier Stage (V101) (fig. 18)

Ref Symbol	Model A B C D E	Signal Corps Stock No.	Name of part and description	Function
C101	x x x x x	3D9054V	CAPACITOR: variable, air, 3-54 mmf.	Antenna tuning.
C102	x x x x x	3K2010121	CAPACITOR: fixed, mica, 100 mmf, $\pm 10\%$, 500 vdcw.	Grid coupling.
C103	x x x x x	3K2010121	CAPACITOR: fixed, mica, 100 mmf, $\pm 10\%$, 500 vdcw.	Screen bypass.
C104	x x x x x	3D9054V	CAPACITOR: variable, air 3-54 mmf.	Plate tuning.
C105	x x x x x	3D2027132	CAPACITOR: fixed, mica, 270 mmf, $\pm 5\%$.	Plate bypass.
R101	x x x x x	3RC20AE105K	RESISTOR: fixed, composition, 1 meg, $\pm 10\%$, $\frac{1}{2}$ w.	Grid bias.
R102	x x x x x	3RC31AE104K	RESISTOR: fixed, composition, 100,000 ohm, $\pm 10\%$, 1 w.	Screen dropping.
P101	x x x x x	2Z8799-239	CONNECTOR: female contact.	Antenna coupling.
V101	x x x x x	2J6AC7	TUBE: electron JAN-6AC7 (VT-112)	First r-f amplifier.
VS101	x x x x x	2Z8678.26	SOCKET: tube, standard, octal, molded bakelite.	Tube socket.
T101	x x x x x	3C302K-1	COILS: radio, r-f, 70 to 100 mc.	Antenna tuning
T102	x x x x x	2C4180-19/C1	COIL: radio, r-f, 70 to 100 mc.	First r-f tuning.



CONDITIONS OF TEST:

BEFORE MEASURING ANY RESISTANCES, REMOVE A-C LINE CORD FROM OUTLET.
VOLTAGE AND RESISTANCE MEASUREMENTS ARE BETWEEN POINTS INDICATED ON CHASSIS UNLESS OTHERWISE NOTED.
POSITIVE POTENTIALS ARE INDICATED UNLESS OTHERWISE NOTED.
ALL MEASUREMENTS MADE WITH A 1,000 OHMS PER VOLT METER.
ALL VACUUM TUBES IN THEIR SOCKETS.

 IS SYMBOL FOR FIXED CAPACITOR.

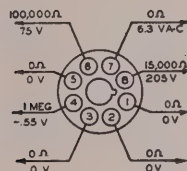
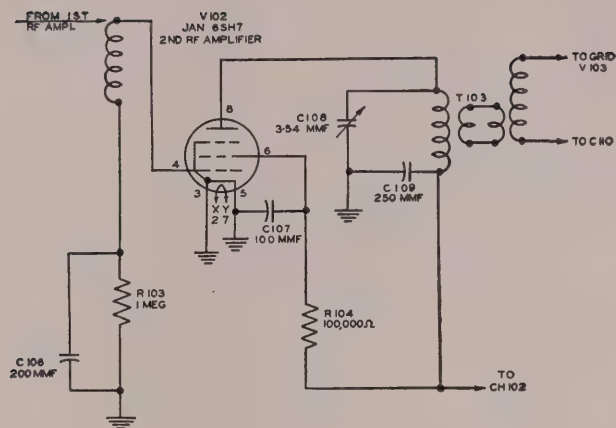
 IS SYMBOL FOR VARIABLE CAPACITOR.

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Figure 18. First r-f amplifier stage, circuit diagram.

55. Second r-f Amplifier Stage (V102) (fig. 19)

Ref Symbol	Model A B C D E	Signal Corps Stock No.	Name of part and description	Function
C106	x x x x x	3K2020121	CAPACITOR: fixed, mica, 200 mmf, $\pm 10\%$, 500 vdcw.	Grid bypass.
C107	x x x x x	3K2010121	CAPACITOR: fixed, mica, 100 mmf, $\pm 10\%$, 500 vdcw.	Screen bypass.
C108	x x x x x	3D9054V	CAPACITOR: variable, air 3-54 mmf.	Plate tuning.
C109	x x x x x	3D2027132	CAPACITOR: fixed, mica, 270 mmf, $\pm 5\%$, 500 vdcw.	Plate bypass.
R103	x x x x x	3RC20AE105K	RESISTOR: fixed, composition, 1 meg. $\pm 10\%$, $\frac{1}{2}$ w.	Grid bias.
R104	x x x x x	3RC31AE104K	RESISTOR: fixed, composition, 10,000 ohm, $\pm 10\%$, 1 w.	Screen dropping.
V102	x x x x x	2J6SH7	TUBE: electron, JAN-6SH7.	2d r-f amplifier.
VS102	x x x x x	2Z8795.12	SOCKET: tube, standard, octal molded bakelite.	Tube socket.
T103	x x x x x	2C4180-19/C3	COIL: radio, RF, 70 to 100 mc.	2d r-f tuning.



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VOLTAGE AND RESISTANCE MEASUREMENTS ARE BETWEEN POINTS INDICATED ON CHASSIS UNLESS OTHERWISE NOTED.
POSITIVE POTENTIALS ARE INDICATED UNLESS OTHERWISE NOTED.
ALL MEASUREMENTS MADE WITH A 1,000 OHMS PER VOLT METER.
ALL VACUUM TUBES IN THEIR SOCKETS.



IS SYMBOL FOR FIXED CAPACITOR.



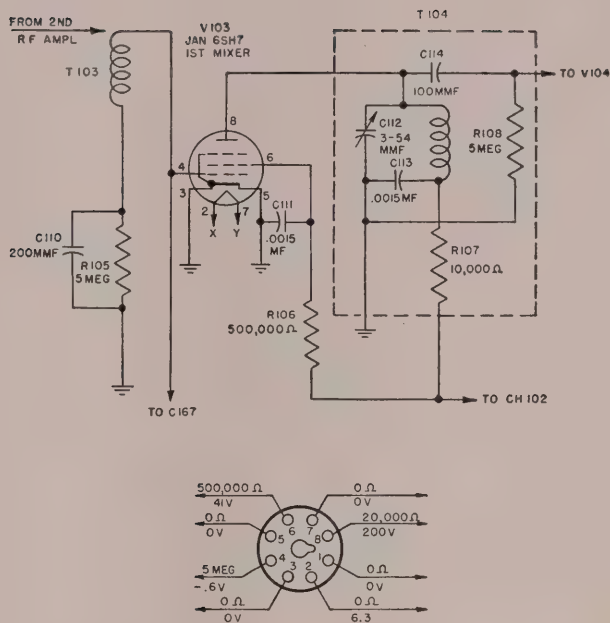
IS SYMBOL FOR VARIABLE CAPACITOR.

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Figure 19. Second r-f amplifier stage, circuit diagram.

56. First Mixer Stage (V103) (fig. 20)

Ref Symbol	Model A B C D E	Signal Corps Stock No.	Name of part and description	Function
C110	x x x x x	3K2020121	CAPACITOR: fixed, mica, 200 mmf, $\pm 10\%$, 500 vdcw.	Grid bypass.
C111	x x x x x	3K3015221	CAPACITOR: fixed, mica, 1,500 mmf, $\pm 10\%$, 500 vdcw.	Screen bypass.
C112	x x x x x	3D9054V	CAPACITOR: variable, air 3-54 mmf, part of T104 assembly.	Plate tuning.
C113	x x x x x	3K3015221	CAPACITOR: fixed, mica, 1,500 mmf, $\pm 10\%$, 500 vdcw.	Plate bypass.
R105	x x x x x	3RC20AE515J	RESISTOR: mixed, composition, 5.1 meg, $\pm 5\%$, $\frac{1}{2}$ w.	Grid bias.
R106	x x x x x	3RC31AE514J	RESISTOR: fixed, composition, 510,000 ohm, $\pm 5\%$, 1 w.	Screen dropping.
R107	x x x x x	3RC31AE103K	RESISTOR: fixed, composition, 10,000 ohm, $\pm 10\%$, 1 w.	Plate isolation.
V103	x x x x x	2J6SH7	TUBE: electron, JAN-6SH7.	First mixer.
VS103	x x x x x	2Z8795.12	SOCKET: tube, standard, octal, moulded bakelite.	Tube socket.
T104	x x x x x	2C4180-19/C4	COIL: radio, r-f, 32.5 to 47.5 mc.	First mixer.



CONDITIONS OF TEST:

BEFORE MEASURING ANY RESISTANCES, REMOVE A-C LINE CORD FROM OUTLET.
VOLTAGE AND RESISTANCE MEASUREMENTS ARE BETWEEN POINTS INDICATED ON CHASSIS UNLESS OTHERWISE NOTED.
POSITIVE POTENTIALS ARE INDICATED UNLESS OTHERWISE NOTED.
ALL MEASUREMENTS MADE WITH A 1,000 OHMS PER VOLT METER.
ALL VACUUM TUBES IN THEIR SOCKETS.



IS SYMBOL FOR FIXED CAPACITOR.



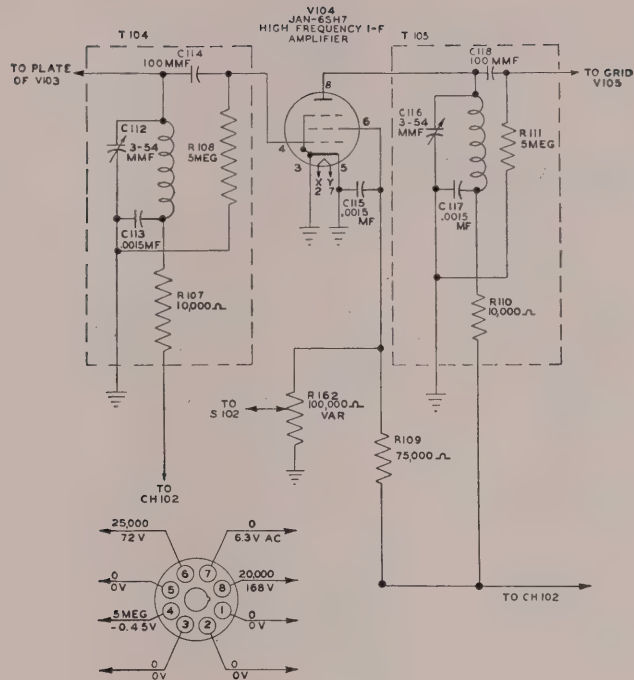
IS SYMBOL FOR VARIABLE CAPACITOR.

TL10235

Figure 20. First mixer stage, circuit diagram.

57. First i-f (High-Frequency) Amplifier Stage (V104) (fig. 21)

Ref Symbol	Model A B C D E	Signal Corps Stock No.	Name of part and description	Function
C114	x x x x x	3K2010121	CAPACITOR: fixed, mica, 100 mmf, $\pm 10\%$, 500 vdcw.	Grid coupling.
C115	x x x x x	3K3015221	CAPACITOR: fixed, mica, 1,500 mmf, $\pm 10\%$, 500 vdcw.	Screen bypass.
C116	x x x x x	3D9054V	CAPACITOR: variable, air 3-54 mmf, part of T104 assembly.	Plate tuning.
C117	x x x x x	3K3015221	CAPACITOR: fixed mica, 1,500 mmf, $\pm 10\%$, 500 vdcw.	Plate bypass.
R108	x x x x x	3RC20AE515J	RESISTOR: fixed, composition, 5.1 meg, $\pm 5\%$, $\frac{1}{2}$ w.	Grid bias.
R109	x x x x x	3RC31AE753J	RESISTOR: fixed, composition, 75,000 ohm, $\pm 10\%$, 1 w.	Screen dropping.
R110	x x x x x	3RC31AE103K	RESISTOR: fixed, composition, 10,000 ohm, $\pm 10\%$, 1 w.	Plate isolation.
V104	x x x x x	2J6SH7	TUBE: electron, JAN-6SH7.	First i-f amplifier.
VS104	x x x x x	2Z8795.12	SOCKET: tube, standard, octal, moulded bakelite.	Tube socket.
T105	x x x x x	2Z9643.101	TRANSFORMER: i-f, 32.5 to 47.5 mc.	First i-f tuning.



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POSITIVE POTENTIALS ARE INDICATED UNLESS OTHERWISE NOTED.
ALL MEASUREMENTS MADE WITH A 1,000 OHMS PER VOLT METER.
ALL VACUUM TUBES IN THEIR SOCKETS.



IS SYMBOL FOR FIXED CAPACITOR.



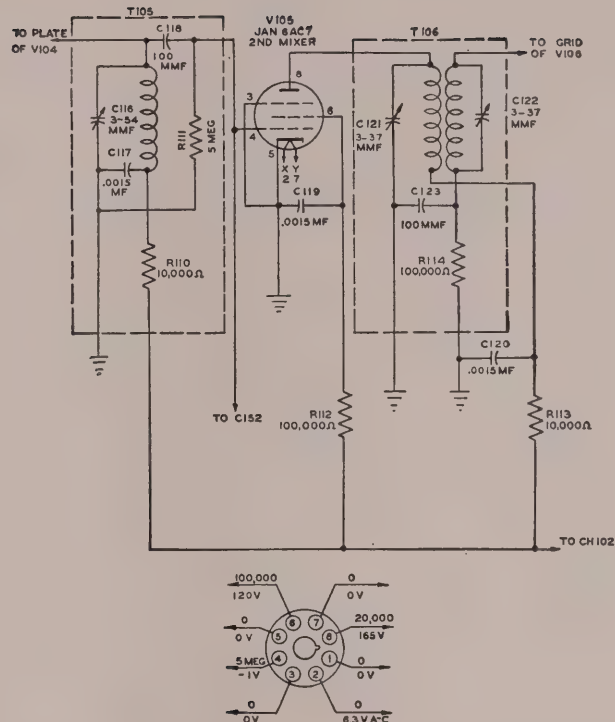
IS SYMBOL FOR VARIABLE CAPACITOR.

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Figure 21. First i-f amplifier stage, circuit diagram.

58. Second i-f Mixer Stage (V105) (fig. 22)

Ref Symbol	Model A B C D E	Signal Corps Stock No.	Name of part and description	Function
C118	x x x x x	3K2010121	CAPACITOR: fixed, mica, 100 mmf, $\pm 10\%$, 500 vdcw.	Grid coupling.
C119	x x x x x	3K3015221	CAPACITOR: fixed, mica, 1,500 mmf, $\pm 10\%$, 500 vdcw.	Screen bypass.
C120	x x x x x	3K3015221	CAPACITOR: fixed, mica, 1,500 mmf, $\pm 10\%$, 500 vdcw.	Plate bypass.
C121	x x x x x	3D9037V	CAPACITOR: variable, air 3-37 mmf, part of T106 assembly.	Plate tuning.
R111	x x x x x	3RC20AE515J	RESISTOR: fixed, composition, 5.1 meg, $\pm 5\%$, $\frac{1}{2}$ w.	Grid bias.
R112	x x x x x	3RC31AE104K	RESISTOR: fixed, composition, 100,000 ohm, $\pm 10\%$, 1 w.	Screen dropping.
R113	x x x x x	3RC31AE103K	RESISTOR: fixed, composition, 10,000 ohm, $\pm 10\%$.	Plate isolation.
V105	x x x x x	2J6AC7	TUBE: electron, JAN-6AC7 (VT-112).	Second mixer.
VS104	x x x x x	2Z8795.12	SOCKET: tube, standard octal, moulded bakelite.	Tube socket.
T106	x x x x x	2Z9643.59	TRANSFORMER: 5 mc.	Second mixer tuning.



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VOLTAGE AND RESISTANCE MEASUREMENTS ARE BETWEEN POINTS INDICATED ON CHASSIS UNLESS OTHERWISE NOTED.
POSITIVE POTENTIALS ARE INDICATED UNLESS OTHERWISE NOTED.
ALL MEASUREMENTS MADE WITH A 1,000 OHMS PER VOLT METER.
ALL VACUUM TUBES IN THEIR SOCKETS.

⊢ IS SYMBOL FOR FIXED CAPACITOR.

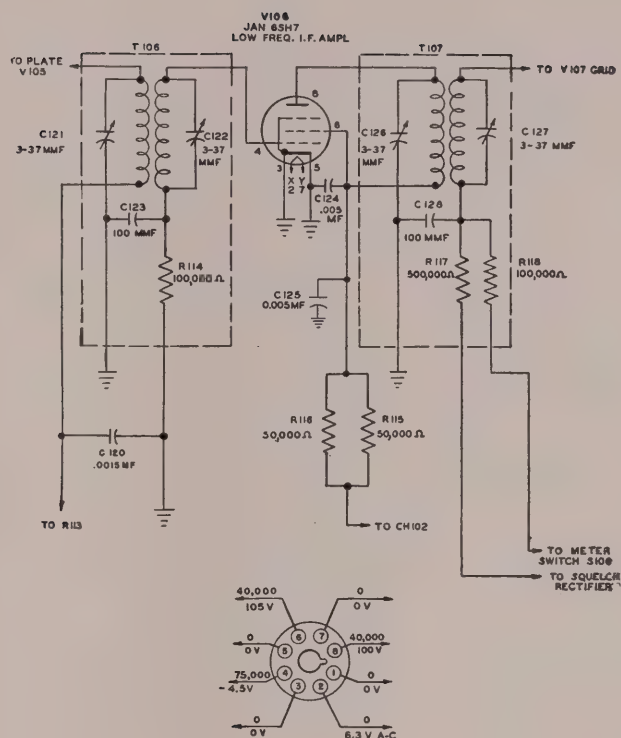
⊢ IS SYMBOL FOR VARIABLE CAPACITOR.

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Figure 22. Second i-f mixer stage, circuit diagram.

59. Second i-f (Low-Frequency) Amplifier Stage (V106) (fig. 23)

Ref Symbol	Model A B C D E	Signal Corps Stock No.	Name of part and description	Function
C122	x x x x x	3D9037V	CAPACITOR: variable, air 3-37 mmf, part of T106 assembly.	Grid tuning.
C123	x x x x x	3K2010121	CAPACITOR: fixed, mica, 100 mmf, $\pm 10\%$, 500 vdcw.	Grid bypass.
C124	x x x x x	3K3551232	CAPACITOR: fixed, mica, 5,100 mmf, $\pm 5\%$, 500 vdcw.	Plate and screen bypass.
C125	x x x x x	3K3551232	CAPACITOR: fixed, mica, 5,100 mmf, $\pm 5\%$, 500 vdcw.	Plate and screen bypass.
C126	x x x x x	3D9037V	CAPACITOR: variable, air, 3-37 mmf, part of T107 assembly.	Plate tuning.
R114	x x x x x	3RC20AE104K	RESISTOR: fixed, composition, 100,000 ohm, $\pm 10\%$, $\frac{1}{2}$ w.	Grid bias.
R115	x x x x x	3RC31AE513J	RESISTOR: fixed, composition, 51,000 ohm, $\pm 5\%$, 1 w.	Plate and screen dropping.
R116	x x x x x			
V106	x x x x x	2J6SH7	TUBE: electron, JAN-SH7.	Second i-f amplifier.
VS106	x x x x x	2Z8795.12	SOCKET: tube, standard, octal.	Tube socket.
T107	x x x x x	2C4180-19/T3	TRANSFORMER: 5 mc.	First limiter tuning.



CONDITIONS OF TEST:

BEFORE MEASURING ANY RESISTANCES, REMOVE A-C LINE CORD FROM OUTLET.
VOLTAGE AND RESISTANCE MEASUREMENTS ARE BETWEEN POINTS INDICATED ON CHASSIS UNLESS OTHERWISE NOTED.
POSITIVE POTENTIALS ARE INDICATED UNLESS OTHERWISE NOTED.
ALL MEASUREMENTS MADE WITH A 1,000 OHMS PER VOLT METER.
ALL VACUUM TUBES IN THEIR SOCKETS.

⎓ IS SYMBOL FOR FIXED CAPACITOR.

⎓ IS SYMBOL FOR VARIABLE CAPACITOR.

TL 10207

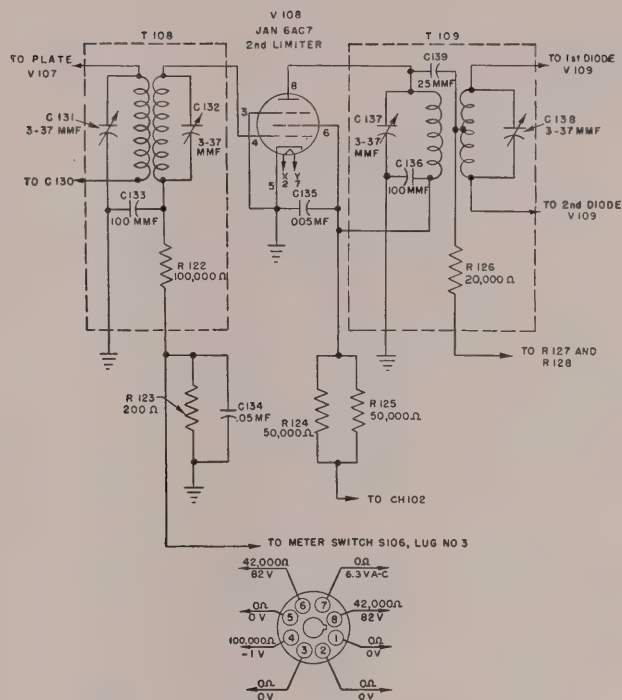
Figure 23. Second i-f amplifier stage, circuit diagram.

60. First Limiter Stage (V107) (fig. 24)

Ref Symbol	Model A B C D E	Signal Corps Stock No.	Name of part and description	Function
C127	x x x x x	.....	CAPACITOR: variable, air, 3-37 mmf, part of T107 assembly.	Grid tuning.
C128	x x x x x	3K2010121	CAPACITOR: fixed, mica, 100 mmf, $\pm 10\%$, 500 vdcw.	Grid bypass.
C129	x x x x x	3DA50-103	CAPACITOR: fixed, paper 3-section 50,000-50,000-50,000 mmf, $\pm 20\%$, 400 vdcw.	Meter bypass.
C130	x x x x x	3K3551232	CAPACITOR: fixed, mica, 5,100 mmf, $\pm 5\%$, 500 vdcw.	Plate and screen bypass.
C131	x x x x x	.....	CAPACITOR: variable, air, 3-37 mmf, part of T108 assembly.	Plate tuning.
R117	x x x x x	3RC20AE514J	RESISTOR: fixed, composition, 510,000 ohm, $\pm 5\%$, $\frac{1}{2}$ w.	Grid isolation.
R118	x x x x x	3RC20AE104K	RESISTOR: fixed, composition, 100,000 ohm, $\pm 10\%$, $\frac{1}{2}$ w.	Grid bias.
R119	x x x x x	3RC20AE511J	RESISTOR: fixed, composition, 510 ohm, $\pm 5\%$, $\frac{1}{2}$ w.	Meter circuit shunt.
R120	x x x x x	3RC31AE513J	RESISTOR: fixed, composition, 51,000 ohm, $\pm 5\%$, 1 w.	Plate and screen dropping.
R121	x x x x x	.....	.....	.....
V107	x x x x x	2J6SH7	TUBE: electron, JAN-SH7.	First limiter.
VS107	x x x x x	2Z8795.12	SOCKET: tube, standard, octal, moulded bakelite.	Tube socket.
T108	x x x x x	2C4180-19/T1	TRANSFORMER: 5 mc.	2d limiter tuning.

61. Second Limiter Stage (V108) (fig. 25)

Ref Symbol	Model A B C D E	Signal Corps Stock No.	Name of part and description	Function
C132	x x x x x	.....	CAPACITOR: variable, air 3-37 mmf, part of T108 assembly.	Grid tuning.
C133	x x x x x	3K2010121	CAPACITOR: fixed, mica, 100 mmf, $\pm 10\%$, 500 vdcw.	Grid bypass.
C134	x x x x x	3DA50-103	CAPACITOR: fixed, paper, 3-section 50,000-50,000-50,000 mmf, $\pm 20\%$, 400 vdcw.	Meter bypass.
C135	x x x x x	3K3551232	CAPACITOR: fixed, mica, 5,100 mmf, $\pm 5\%$, 500 vdcw.	Plate and screen bypass.
C136	x x x x x	3K2010121	CAPACITOR: fixed, mica, 100 mmf, $\pm 10\%$, 500 vdcw.	Plate bypass.
C137	x x x x x	.....	CAPACITOR: variable, air 3-37 mmf, part of T109 assembly.	Plate tuning.
R122	x x x x x	3RC20AE104K	RESISTOR: fixed, composition, 100,000 ohm, $\pm 10\%$, $\frac{1}{2}$ w.	Grid bias.
R123	x x x x x	3RC20AE201J	RESISTOR: fixed, composition, 200 ohm, $\pm 5\%$, $\frac{1}{2}$ w.	Meter circuit shunt.
R124, R125.	x x x x x	3RC31AE513J	RESISTOR: fixed, composition, 51,000 ohm, $\pm 5\%$, 1 w.	Plate and screen dropping.
V108	x x x x x	2J6AC7	TUBE: electron, JAN-6AC7 (VT-112).	Second limiter.
VS108	x x x x x	2Z8795.12	SOCKET: tube, standard, octal, moulded bakelite.	Tube socket.
T109	x x x x x	2C4180-19/T2	TRANSFORMER: 5 mc.	Discriminator tuning.



CONDITIONS OF TEST:
 BEFORE MEASURING ANY RESISTANCES, REMOVE A-C LINE CORD FROM OUTLET.
 VOLTAGE AND RESISTANCE MEASUREMENTS ARE BETWEEN POINTS INDICATED ON CHASSIS UNLESS OTHERWISE NOTED.
 POSITIVE POTENTIALS ARE INDICATED UNLESS OTHERWISE NOTED.
 ALL MEASUREMENTS MADE WITH A 1,000 OHMS PER VOLT METER.
 ALL VACUUM TUBES IN THEIR SOCKETS.

IS SYMBOL FOR FIXED CAPACITOR.
 IS SYMBOL FOR VARIABLE CAPACITOR.

TL10342

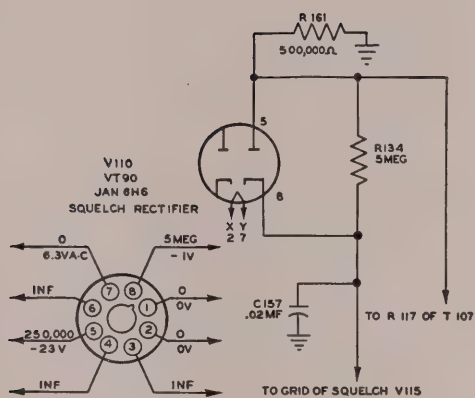
Figure 25. Second limiter stage, circuit diagram.

62. Discriminator Stage (V109) (fig. 26)

Ref Symbol	Model A B C D E	Signal Corps Stock No.	Name of part and description	Function
C138	x x x x x	.....	CAPACITOR: variable, air 3-37 mmf, part of T109 assembly.	Discriminator tuning.
C139	x x x x x	3K2027021	CAPACITOR: fixed, mica, 27 mmf, $\pm 10\%$, 500 vdcw.	Discriminator tuning.
C140	x x x x x	3K2010121	CAPACITOR: fixed, mica, 100 mmf, $\pm 10\%$, 500 vdcw.	Discriminator load bypass.
C142	x x x x x	3DA50-103	CAPACITOR: fixed, paper, 3-section, 50,000-50,000-50,000 mmf, $\pm 20\%$, 400 vdcw.	Meter bypass.
R126	x x x x x	.....	RESISTOR: fixed, carbon, 20,000 ohm, $\pm 10\%$, part of T109 assembly.	Transformer r-f isolation.
R127, R128.	x x x x x	3RC20AE104K	RESISTOR: fixed, composition, 100,000 ohm, $\pm 10\%$, $\frac{1}{2}$ w.	Discriminator load.
R129	x x x x x	3RC31AE104K	RESISTOR: fixed, composition, 100,000 ohm, $\pm 10\%$, 1 w.	Audio voltage divider.
R130	x x x x x	3RC31AE103K	RESISTOR: fixed, composition, 10,000 ohm, $\pm 10\%$, 1 w.	Audio voltage divider.
R131	x x x x x	3RC31AE512J	RESISTOR: fixed, composition, 5,100 ohm, $\pm 5\%$, 1 w.	Meter circuit shunt.
V109	x x x x x	2J6H6	TUBE: electron, JAN-6H6 (VT-90).	Discriminator.
VS109	x x x x x	2Z8795.12	SOCKET: tube, standard, octal, moulded bakelite.	Tube socket.

63. Squelch Rectifier Stage (V110) (fig. 27)

Ref Symbol	Model A B C D E	Signal Corps Stock No.	Name of part and description	Function
R134	x x x x x	3RC20AE515J	RESISTOR: fixed, composition, 5.1 meg, $\pm 5\%$, $\frac{1}{2}$ w.	Squelch rectifier leak.
R161	x x x x x	3RC20AE514J	RESISTOR: fixed, composition, 510,000 ohm, $\pm 5\%$, $\frac{1}{2}$ w.	Squelch dropping.
V110	x x x x x	2J6H6	TUBE: electron, JAN-6H6 (VT-90).	Squelch rectifier.
VS110	x x x x x	2Z8795.12	SOCKET: tube, standard, octal.	Tube socket.



CONDITIONS OF TEST:

BEFORE MEASURING ANY RESISTANCES, REMOVE 'A-C LINE CORD FROM OUTLET.
VOLTAGE AND RESISTANCE MEASUREMENTS ARE BETWEEN POINTS INDICATED ON CHASSIS UNLESS OTHERWISE NOTED.
POSITIVE POTENTIALS ARE INDICATED UNLESS OTHERWISE NOTED.
ALL MEASUREMENTS MADE WITH A 1,000 OHMS PER VOLT METER.
ALL VACUUM TUBES IN THEIR SOCKETS.



IS SYMBOL FOR FIXED CAPACITOR,

TL 10297

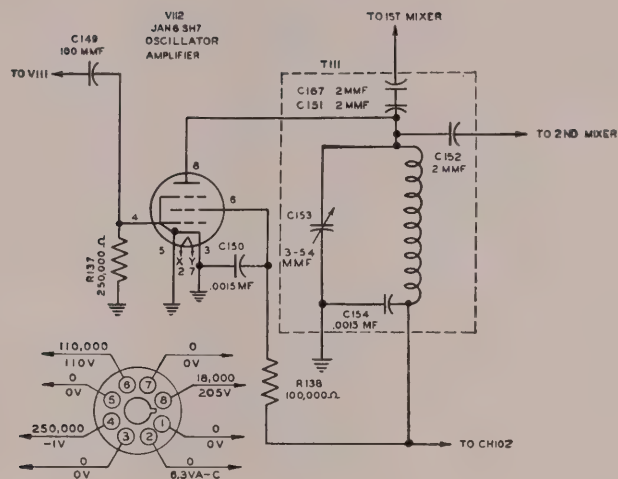
Figure 27. Squelch rectifier stage, circuit diagram.

64. Crystal Oscillator Stage (V111) (fig. 28)

Ref Symbol	Model A B C D E	Signal Corps Stock No.	Name of part and description	Function
C146	x x x x x	3K3015221	CAPACITOR: fixed, mica, 1,500 mmf, $\pm 10\%$, 500 vdcw.	Screen bypass.
C147	x x x x x	.....	CAPACITOR: variable, air 3-54 mmf, part of T110 assembly.	Plate tuning.
C148	x x x x x	3K3015221	CAPACITOR: fixed, mica, 1,500 mmf, $\pm 10\%$, 500 vdcw.	Plate bypass.
C149	x x x x x	3K2010121	CAPACITOR: fixed, mica, 100 mmf, $\pm 10\%$, 500 vdcw.	Plate coupling.
R135	x x x x x	3RC20AE104K	RESISTOR: fixed, composition, 100,000 ohm, $\pm 10\%$, $\frac{1}{2}$ w.	Grid bias.
R136	x x x x x	3RC31AE104K	RESISTOR: fixed, composition, 100,000 ohm, $\pm 10\%$, 1 w.	Screen dropping.
V111	x x x x x	2J6SH7	TUBE: electron, JAN-6SH7.	Crystal oscillator.
VS111	x x x x x	2Z8795.12	SOCKET: tube, standard, octal, moulded bakelite.	Tube socket.
T110	x x x x x	2C4180-19/C2'	COIL: R-F, 37.5 to 52.5 mc.	Crystal oscillator tuning coil.

65. Oscillator Amplifier Stage (V112) (fig. 29)

Ref Symbol	Model A B C D E	Signal Corps Stock No.	Name of part and description	Function
C150	x x x x x	3K3015221	CAPACITOR: fixed, mica, 1,500 mmf, $\pm 10\%$, 500 vdcw.	Screen bypass.
C151	x x x x x	3D9002-9	CAPACITOR: fixed, ceramic 2 mmf, $\pm 12.5\%$, 500 vdcw.	Grid coupling to mixer V103.
C152	x x x x x	3D9002-9	CAPACITOR: fixed, ceramic 2 mmf, $\pm 12.5\%$, 500 vdcw.	Grid coupling to mixer V105.
C153	x x x x x	3D9054V	CAPACITOR: variable, air, 3-54 mmf, part of T111 assembly.	Plate tuning.
C154	x x x x x	3K3015221	CAPACITOR: fixed, mica, 1,500 mmf, $\pm 10\%$, 500 vdcw.	Plate bypass.
R137	x x x x x	3RC20AE244J	RESISTOR: fixed, composition, 240,000 ohm, $\pm 5\%$, $\frac{1}{2}$ w.	Grid bias.
V112	x x x x x	2J6SH7	TUBE: electron, JAN-6SH7.	Oscillator amplifier.
VS112	x x x x x	2Z8795.12	SOCKET: tube, standard, octal.	Tube socket.
T111	x x x x x	2C4180-19/C5	COIL: R-F, 37.5 to 52.5 mc.	Oscillator amplifier tuning.



CONDITIONS OF TEST:

BEFORE MEASURING ANY RESISTANCES, REMOVE A-C LINE CORD FROM OUTLET.
VOLTAGE AND RESISTANCE MEASUREMENTS ARE BETWEEN POINTS INDICATED ON CHASSIS UNLESS OTHERWISE NOTED.
POSITIVE POTENTIALS ARE INDICATED UNLESS OTHERWISE NOTED.
ALL MEASUREMENTS MADE WITH A 1,000 OHMS PER VOLT METER.
ALL VACUUM TUBES IN THEIR SOCKETS.



IS SYMBOL FOR FIXED CAPACITOR.



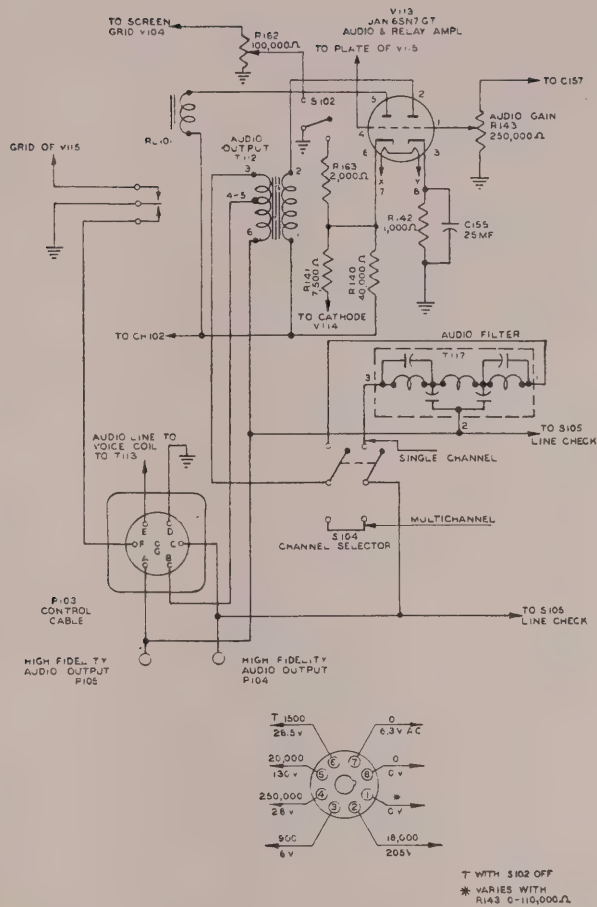
IS SYMBOL FOR VARIABLE CAPACITOR.

TL 10338

Figure 29. Oscillator amplifier stage, circuit diagram.

66. Audio Output and Carrier Operated Relay Amplifier Stage (V113) (fig. 30)

Ref Symbol	Model A B C D E	Signal Corps Stock No.	Name of part and description	Function
RL101	x x x x x	2Z7589-13	RELAY: contact arrangement 1A1C, 6,500-ohm coil.	Automatic transmitter control
C155	x x x x x	3DB25-17	CAPACITOR: fixed, electrolytic, 25 mf, 50 vdcw.	Cathode bypass.
R140	x x x x x	3Z6640-61	RESISTOR: fixed, wire wound, 40,000 ohm, $\pm 10\%$, 10 w.	Cathode voltage divider.
R141	x x x - -	3RC31AE752J	RESISTOR: fixed, composition, 7,500 ohm, $\pm 5\%$, 1 w.	Cathode voltage divider.
R142	x x x x x	3RC31AE102K	RESISTOR: fixed, composition, 1,000 ohm, $\pm 10\%$, 1 w.	Cathode bias.
R143	x x x x x	3Z7498-25.2	RESISTOR: variable, carbon 250,000 ohm, $\pm 20\%$, 1 w, 3 terminals.	Gain control.
R155	x x x - -	3RC20AE102K	RESISTOR: fixed, composition 1,000 ohm, $\pm 10\%$, $\frac{1}{2}$ w.	Audio limiting.
R162	x x x - -	2Z7271-17	RESISTOR: variable, carbon 100,000 ohm, 3 terminals.	Squelch control.
R162	- - - x x	3Z7480-7	RESISTOR: variable, carbon 100,000 ohm, $\pm 10\%$, 3 terminals.	Squelch control.
R163	x x x x x	3RC31AE202J	RESISTOR: fixed, composition, 2,000 ohm, $\pm 5\%$, 1 w.	Squelch dropping.
P103	x x x x x	2Z8677.49	CONNECTOR: female contact, 7 contact.	
P104, P105.	x x x x x	3Z737-21	POST: binding, screw type.	Audio output.
S104	x x x x x	3Z9858-8.71	SWITCH: toggle, DPDT.	Channel selector.
V113	x x x x x	2J6SN7GT	TUBE: electron, JAN-6SN7GT (VT-281)	Audio output and relay amplifier.
T112	x x x x x	2J9632.173	TRANSFORMER: AF, primary 10,000 ohm; secondary 500 ohm, tapped 250 ohm.	High fidelity audio output.
T117	x x x x x	3C317-48	TRANSFORMER: AF, 500 ohm.	Audio filter speaker channel.
VS113	x x x x x	2Z8795.12	SOCKET: tube, standard, octal, moulded bakelite.	Tube socket.
S102	x x x x x	3Z9845-11.4	SWITCH: toggle, SPDT.	Squelch ON-OFF.



CONDITIONS OF TEST
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VOLTAGE AND RESISTANCE MEASUREMENTS ARE BETWEEN POINTS INDICATED ON CHASSIS UNLESS OTHERWISE NOTED
POSITIVE POTENTIALS ARE INDICATED UNLESS OTHERWISE NOTED
ALL MEASUREMENTS MADE WITH A 1,000 OHMS PER VOLT METER
ALL VACUUM TUBES IN THEIR SOCKETS

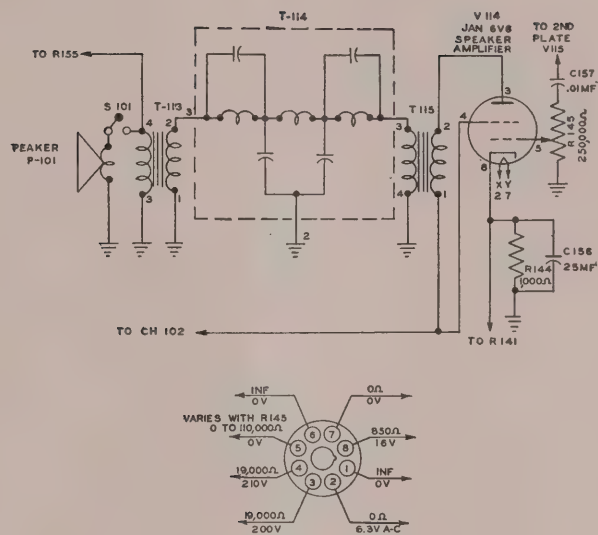
⊥ IS SYMBOL FOR FIXED CAPACITOR

TL 18325

Figure 50. Audio output and carrier operated relay amplifier stage, circuit diagram.

67. Speaker Amplifier Stage (V114) (fig. 31)

Ref Symbol	Model A B C D E	Signal Corps Stock No.	Name of part and description	Function
C156	x x x x x	3DB25-17	CAPACITOR: fixed, electrolytic, 25 mf, 50 vdcw.	Cathode bypass.
C157	- x - - -	3DA10-158	CAPACITOR: fixed, paper, oil- filled, 10,000 mmf, $\pm 20\%$, 400 vdcw.	Grid coupling.
C157	- x - - -	3DA20-81	CAPACITOR: fixed, paper, oil- filled, 20,000 mmf, $\pm 20\%$, 600 vdcw.	Grid coupling.
R144	- - - x x	3RC31AE511J	RESISTOR: fixed, composition, 510 ohm, $\pm 5\%$, 1 w.	Cathode bias.
R145	x x x x x	3Z7498-25.2	RESISTOR: variable, carbon, 250,000 ohm $\pm 20\%$, 1 w, 3 terminals.	Gain control.
V114	x x x x x	2J6V6GT/G	TUBE: electron, JAN-6V6GT/G (VT-107-A).	Speaker amplifier.
T113	x x x x x	2Z9632.345	TRANSFORMER: AF, primary, 500 ohm, secondary 6 ohm.	Audio line to VC of speaker
T114	x x x x x	3C317-48	TRANSFORMER: AF, 500 ohm.	Audio filter speaker channel.
T115	x x x x x	2Z9632.30	TRANSFORMER: AF, primary 10,000 ohms, secondary 500 ohm impedance.	Tube socket.
VS114	x x x x x	2Z8795.12	SOCKET: tube, standard, octal, moulded bakelite.	Tube socket.
S101	x - - - -	3Z9857.42	SWITCH: toggle, SPST.	Speaker muting.
SP101	x x x x x	6C35-5	SPEAKER: magnetic, 5" cone PM, 3 w, voice coil impedance 4 ohm.	Speaker.



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 POSITIVE POTENTIALS ARE INDICATED UNLESS OTHERWISE NOTED.
 ALL MEASUREMENTS MADE WITH A 1,000 OHMS PER VOLT METER.
 ALL VACUUM TUBES IN THEIR SOCKETS.



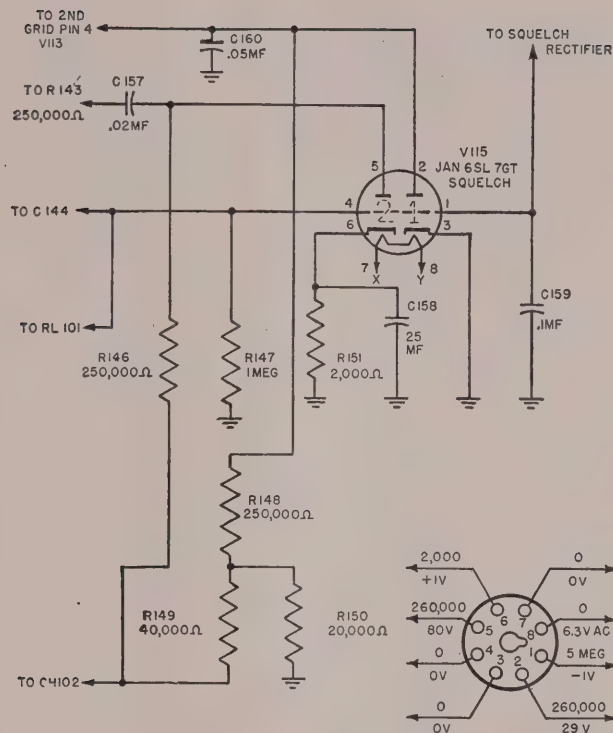
IS SYMBOL FOR FIXED CAPACITOR.

TL 10254

Figure 31. Speaker amplifier stage, circuit diagram.

68. Squelch and First Audio Stage (V115) (fig. 32)

Ref Symbol	Model A B C D E	Signal Corps Stock No.	Name of part and description	Function
C158	x x x x x	3DB25-17	CAPACITOR: fixed, electrolytic, 25 mf, 50 vdcw.	Cathode bypass first audio.
C159	x x x x x	3DA50-103	CAPACITOR: fixed, paper, 3- section 50,000-50,000-50,000 mmf, $\pm 20\%$, 400 vdcw.	Squelch grid bypass.
C160	x x x x x	3DA50-103	CAPACITOR: fixed, paper, 3- section 50,000-50,000-50,000 mmf, $\pm 20\%$, 400 vdcw.	Squelch plate bypass.
R151	x x x x x	3RC31AE202J	RESISTOR: fixed, composition, 2,000 ohm, $\pm 5\%$, 1 w.	Cathode bias first audio.
R148	x x x x x	3RC31AE244J	RESISTOR: fixed, composition 240,000 ohm, $\pm 5\%$, 1 w.	Squelch plate load.
R149	x x x x x	3RC31AE393J	RESISTOR: fixed, composition, 39,000 ohm, $\pm 5\%$, 1 w.	Cathode voltage divider.
V115	x x x x x	2J6SL7GT	TUBE: electron, JAN-6SL7GT (VT-229).	Squelch and first audio.
VS115	x x x x x	2Z8795.12	SOCKET: tube, standard, octal, moulded bakelite.	Tube socket.



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POSITIVE POTENTIALS ARE INDICATED UNLESS OTHERWISE NOTED.
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ALL VACUUM TUBES IN THEIR SOCKETS.



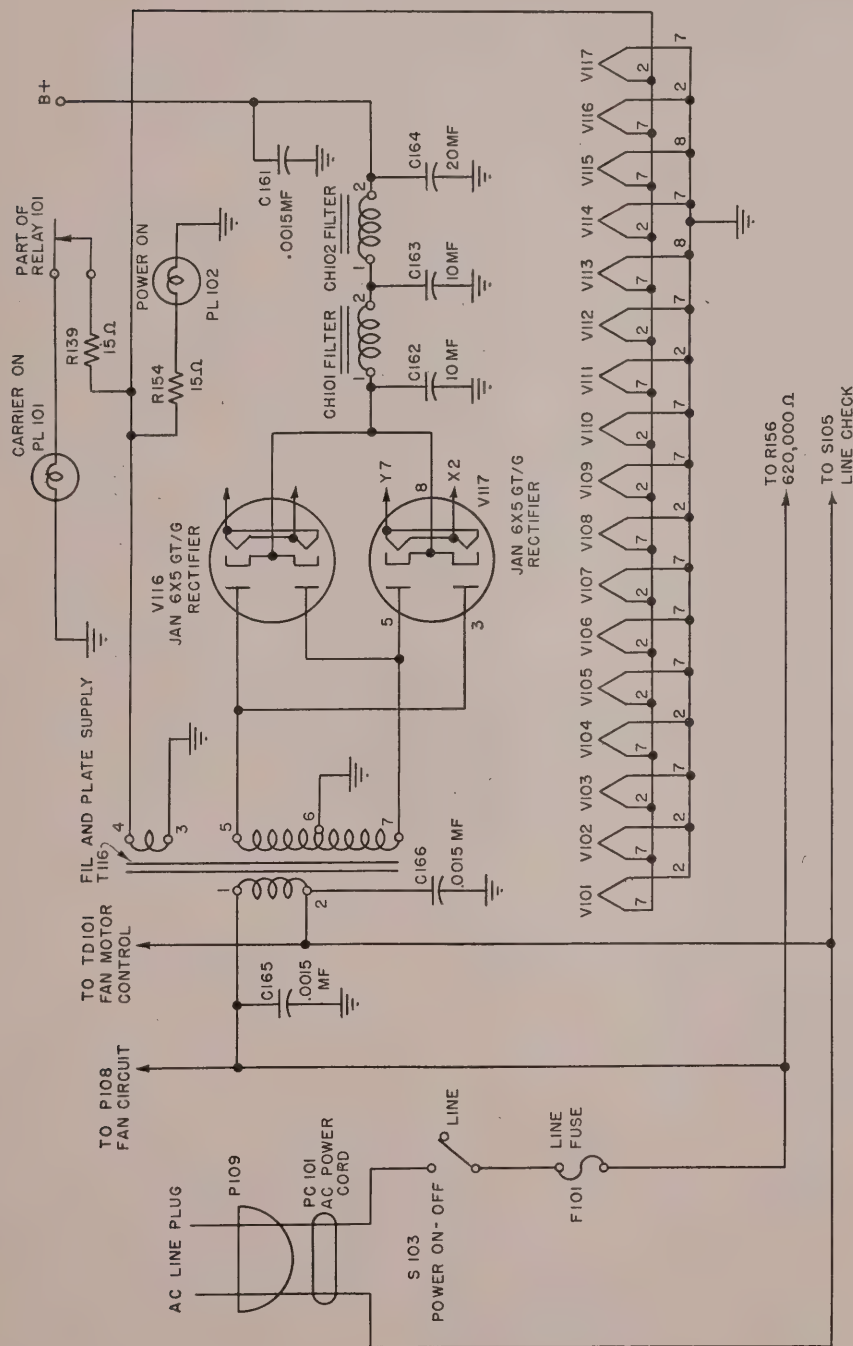
IS SYMBOL FOR FIXED CAPACITOR.

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Figure 32. Squelch and first audio stage, circuit diagram.

69. Power Rectifier Stage (V116 and V117) (fig. 33)

Ref Symbol	Model A B C D E	Signal Corps Stock No.	Name of part and description	Function
C161	x x x x x	3K3015221	CAPACITOR: fixed, mica, 1,500 mmf, $\pm 10\%$, 500 vdcw.	High voltage r-f bypass.
C162	x x x - -	3DB10-58.1	CAPACITOR: fixed, electrolytic, plug-in, 10-10-mf, 450 vdcw.	High voltage r-f bypass.
C163	x x x - -			
C164	x x x - -			
C162	- - - x x	3DB20-72	CAPACITOR: fixed, electrolytic plug-in, 20-20 mf, $\pm 40\%$ -10%, 350 vdcw.	High voltage r-f bypass.
C163	- - - x x			
C164	- - - x x			
C165	x x x x x	3K3015221	CAPACITOR: fixed, mica, 1,500 mmf, $\pm 10\%$, 500 vdcw.	A-c line bypass.
C166				
R154	x x x x x	3RC31AE150K	RESISTOR: fixed, composition, 15 ohm, $\pm 10\%$, 1 w.	Voltage dropping power ON-OFF ind. lamp.
PL101	x x x x x	2Z5952	LAMP LM-52, 6-8v, 150 ma. Mazda No. 47.	Carrier indicator.
PL102	x x x x x	2Z5952	LAMP LM-52, 6-8v, 150 ma. Mazda No. 47.	Power ON-OFF.
PLS101 ...	x x x x x	2Z5883-105	BRACKET: indicator lamp.	Pilot lamp bracket carrier relay ON-OFF.
PLS102 ...	x x x x x	2Z5883-105	BRACKET: indicator lamp.	Pilot lamp bracket a-c power ON-OFF.
CH101	x x x x x	3C317-45	COIL: AF, choke, 6 hy, 75 ma, 280 dc.	Filter choke.
CH102	x x x x x			
S103	x x x - -	3Z9857.42	SWITCH: toggle, SPST.	POWER ON-OFF.
S103	- - - x x	3Z9849.172	SWITCH: toggle, SPST.	POWER ON-OFF.
T116	x x x x x	2Z9613.388	TRANSFORMER: power, primary 115 vac, 50/60 cyc. secondary 6.3v, 612 amps.	Filament and plate supply.
V116	x x x x x	2J6X5GT/G	TUBE, electron, JAN-6X5GT/G (VT-126-B).	Power rectifier.
V117	x x x x x			
VS116	x x x x x	2Z8795.12	SOCKET: tube, standard, octal moulded bakelite.	Tube socket
VS117	x x x x x	2Z8795.12	SOCKET: tube, standard, octal moulded bakelite.	Capacitor plug in socket.
VS118	x x x x x			
F101	x x x x x	3Z1927	FUSE FU-27: 2 amp, 250 v.	A-c line fuse.
FS101	x x x x x	3Z3285-2	HOLDER: fuse.	A-c line fuse socket.



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POSITIVE POTENTIALS ARE INDICATED UNLESS OTHERWISE NOTED.
RESISTANCE MEASUREMENTS ARE IN OHMS PER VOLT METER.
ALL VACUUM TUBES IN THEIR SOCKETS.

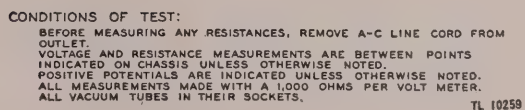
⊥ IS SYMBOL FOR FIXED CAPACITOR.

TL 10304

Figure 33. Power rectifier stage, circuit diagram.

70. Meter M101 and Switches (fig. 34)

Ref Symbol	Model A B C D E	Signal Corps Stock No.	Name of part and description	Function
M101	x x x - -	3F871-2	METER: microammeter, 0-100 ma, -8 to + 6 db, 115 v.	Tuning and audio level indicator.
M101	- - - x x	3F871-9	METER: microammeter, 1-100 ma, -8 to + 6 db, 115 v.	Tuning and audio level indicator.
RE101	x x x x x	3H4702-4	RECTIFIER: input 5 v max; output 5 ma max.	Meter rectifier.
R156	x x x - -	3RC31AE624J	RESISTOR: fixed, composition, 620,000 ohm $\pm$ 5%, 1 w.	Meter multiplier.
R156	- - - x x	3Z6764	RESISTOR: fixed, composition, 640,000 ohm, $\pm$ 5%, 1 w.	Meter multiplier.
R158	x x x x x	3RC31AE302J	RESISTOR: fixed, composition, 3,000 ohm, $\pm$ 5%, 1 w.	Meter multiplier.
R159	x x x x x	3RC31AE152K	RESISTOR: fixed, composition, 1,500 ohm, $\pm$ 10%, 1 w.	Meter multiplier.
R157	- - - x x	3RC20AE202J	RESISTOR: fixed, composition, 2,000 ohm, $\pm$ 5%, $\frac{1}{2}$ w.	Meter multiplier.
R160	x x x x x	3Z9824-31.17	SWITCH: push, DPDT.	Line check.
S105	x x x x x	3Z9858-8.71	SWITCH; toggle, DPDT.	Meter circuit selector.



63

71. Exhaust Fan Stage (fig. 35)

Ref Symbol	Model A B C D E	Signal Corps Stock No.	Name of part and description	Function
FM101	x x x x x	3H3000-42	BLOWER	Cooling.
P107	x x x x x	2Z3022-37	CONNECTOR: male contact.	Fan circuit.
P108	x x x x x	2Z3063-33	CONNECTOR: female contact.	Fan circuit.

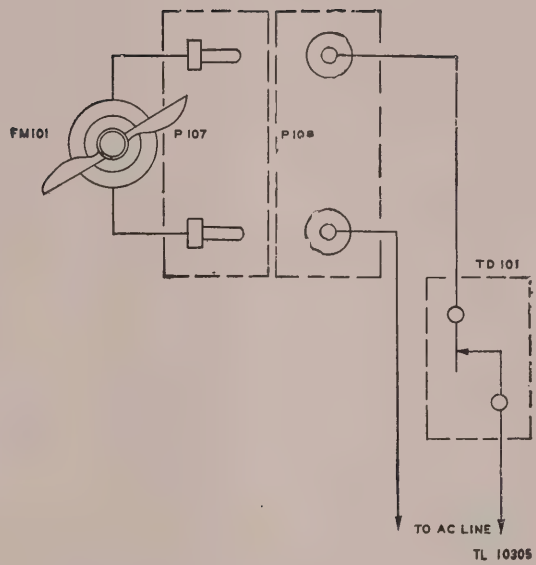


Figure 35. Exhaust fan, circuit diagram.

SECTION IX

SUPPLEMENTARY DATA

72. Parts Identification

The following illustrations and tables are provided to aid in identifying and servicing the various component parts of Radio Receiver R-19(*)/.

73. Jumpers

Required	From	To
1	X-0113 switch.....	Meter
1	No. 2 pin T-114....	R-143-Var
1	R-106 var.....	R-145-Var
1	No. 4 pin T-115....	Ground lug socket V114
1	No. 5 pin-socket V111	Crystal socket
1	No. 3 pin T-114....	Ground lug socket V114
1	R-162	S-102
1	Meter	Ground
1	V-108	R-147
1	No. 2 pin T-117....	S-105
1	No. 2 pin T-117....	No. 6 pin T-112
1	X-0113 switch.....	Meter
1	No. 1 pin T-114....	No. 3 T-115
1	X-0111 switch.....	Speaker
1	No. 1 pin T-112....	No. 2 term. CH-102
1	No. 1 pin T-112....	No. 4 pin V-114
2	No. 6 term. V-113..	R-140
1	No. 4 term. V-114..	No. 1 term. T-115
1	R-104	No. 6 term. C-109
1	R-106	No. 6 term. V-103
1	Stand-off	Stand-off
1	R-136	R-140
1	R-102	No. 1 term. T-115..
1	S-102	R-162
1	No. 1 term. CH-102	No. 1 term. CH-101
2	No. 1 term. CH-101	No. 3 term. C-162..
1	No. 2 term. CH-101	No. 5 term. C-162..
1	R-136	No. 6 term. V-111..
1	R-112	No. 6 term. V-103..
1	R-116	No. 6 term. V-106..
1	R-109	No. 6 term. V-104..
1	R-146	R-136
1	R-149	No. 4 term. P-106..
1	No. 4 term. T-116..	No. 7 term. V-116..
1	No. 7 term. V-111..	No. 2 term. V-112..
1	No. 7 term. V-111..	No. 2 term. V-103..
1	No. 7 term. V-104..	No. 2 term. V-103..
1	No. 2 term. V-105..	No. 2 term. V-112..
1	No. 7 term. V-103..	No. 7 term. V-102..
2	No. 7 term. P-106..	No. 2 term. V-114..
1	No. 7 term. V-113..	No. 2 term. V-114..

Required	From	To
1	R-154	No. 7 term. P-106..
1	No. 8 term. V-115..	No. 7 term. V-113..
1	No. 2 term. V-109..	No. 8 term. V-115..
1	No. 2 term. V-110..	No. 2 term. V-109..
1	No. 2 term. V-109..	No. 7 term. V-108..
1	R-141	No. 6 term. V-113..
1	X-0113 switch term.	X-0113 switch term.
1	R-143	R-145
1	C-144	No. 4 term. V-115..
1	No. 4 term. V-111..	R-135
1	R-130	R-131
1	No. 4 term. V-113..	No. 2 term V-115..
1	No. 2 term. V-115..	R-148
2	No. 5 term. V-115..	R-146
1	No. 2 term. T-115..	No. 3 term. V-114..
1	No. 5 term. V-116..	No. 5 term. V-116..
1	No. 3 term. V-117..	No. 5 term. V-116..

Description	Color	Length
No. 22 stranded copper wire glass braid vinylite.	White-black	4"
Do.....	do.....	4½"
Do.....	do.....	3"
Do.....	do.....	2¾"
Do.....	do.....	1¾"
Do.....	do.....	2"
Do.....	do.....	1¾"
Do.....	do.....	6¾"
Do.....	do.....	3"
Do.....	White-brown	4½"
Do.....	do.....	3"
Do.....	do.....	3¼"
Do.....	do.....	2½"
Do.....	do.....	8¾"
Do.....	White-red	4¾"
Do.....	do.....	5"
Do.....	do.....	5½"
Do.....	do.....	6½"
Do.....	do.....	3¾"
Do.....	do.....	4¾"
Do.....	do.....	5¼"
Do.....	do.....	4¼"
Do.....	do.....	2"
Do.....	do.....	1¾"
Do.....	do.....	3½"
Do.....	do.....	2¾"
Do.....	do.....	4"

Description	Color	Length
No. 22 stranded orange wire glass braid vinylite.	White-red	5"
Do.....	do.....	6 $\frac{3}{4}$ "
Do.....	do.....	4 $\frac{1}{4}$ "
Do.....	do.....	4 $\frac{1}{2}$ "
Do.....	White-orange	3 $\frac{1}{4}$ "
Do.....	do.....	3 $\frac{3}{4}$ "
Do.....	do.....	4 $\frac{1}{4}$ "
Do.....	do.....	7 $\frac{1}{2}$ "
Do.....	do.....	2 $\frac{3}{8}$ "
Do.....	do.....	6 $\frac{3}{4}$ "
Do.....	do.....	4 $\frac{1}{4}$ "
Do.....	do.....	2 $\frac{3}{4}$ "
Do.....	do.....	3 $\frac{1}{4}$ "
Do.....	do.....	1 $\frac{7}{8}$ "
Do.....	do.....	3 $\frac{1}{2}$ "
Do.....	do.....	4 $\frac{1}{2}$ "
Do.....	White-yellow.....	5"
Do.....	do.....	1 $\frac{7}{8}$ "
Do.....	White-green	3 $\frac{1}{2}$ "
Do.....	do.....	4 $\frac{1}{4}$ "
Do.....	do.....	2 $\frac{1}{4}$ "
Do.....	do.....	2 $\frac{1}{2}$ "
Do.....	White-blue	3"
Do.....	do.....	4 $\frac{1}{2}$ "
Do.....	do.....	3 $\frac{3}{4}$ "
Do.....	do.....	3 $\frac{1}{2}$ "
Do.....	do.....	2"

Note: Lists refer to cut lengths. Strip and tin wires $\frac{3}{8}$ inch at each end.

74. Parts Data

Item	No. req	Description
31	1	Audio transformer.
32	2	Filter choke "B," 6 henrys.
33	2	A-f speaker filter.
34	1	Tuning coil (crystal oscillator).
35	1	Tuning coil (oscillator amplifier).
36	1	Audio transformer, 500 to 10,000 ohms.
37	1	Audio transformer, 6 to 500 ohms.
38	1	Power transformer.
39	1	First converter transformer.
40	1	Second converter transformer.
41	1	First limiter tuning coil.
42	1	Second limiter tuning coil.
43	1	Discriminator coil.
44	1	First i-f transformer.
45	1	Antenna tuning coil.
46	1	First r-f transformer.
47	1	Second r-f transformer.
48	1	Meter (0-100 microamperes).
49	1	Mask (front panel).

Item	No. req	Description
50	5	Ceramic stand-off spacers.
51	2	Pointer knobs.
52	1	Power grommet.
52A	1	Meter gasket.
53	1	Dial indicator knob T102.
53A	1	Dial indicator knob T103.
54	1	Fixed resistor, 1,000 ohms, $\frac{1}{2}$ w, $\pm 10\%$.
55	3	Fixed resistor, 100,000 ohms, $\frac{1}{2}$ w, $\pm 10\%$.
56	1	Fixed resistor, 1 meg. $\frac{1}{2}$ w, $\pm 10\%$.
57	1	Fixed resistor, 200 ohms, $\frac{1}{2}$ w, $\pm 10\%$.
58	1	Fixed resistor, 2,000 ohms, $\frac{1}{2}$ w, $\pm 10\%$.
59	1	Fixed resistor, 250,000 ohms, $\frac{1}{2}$ w, $\pm 10\%$.
60	1	Fixed resistor, 500 ohms, $\frac{1}{2}$ w, $\pm 10\%$.
61	1	Fixed resistor, 500,000 ohms, $\frac{1}{2}$ w, $\pm 10\%$.
62	2	Fixed resistor, 5 meg. $\frac{1}{2}$ w, $\pm 10\%$.
63	2	Fixed resistor, 1,000 ohms, $\frac{1}{2}$ w, $\pm 10\%$.
64	1	Variable carbon resistor, 100,000 ohms.
65	2	Variable carbon resistor, 250,000 ohms.
66	1	Wire-wound resistor, 20 w, 40,000 ohms.
67	1	Socket, crystal (2-contact).
68	1	Socket, fuse.
69	1	Receptacle, antenna (female).
71	1	Receptacle, fan.
72	1	Pilot assembly (green).
74	1	Pilot light assembly (red).
75	20	Tube sockets (8-pin).
76	2	No. 10 solder lugs.
77	9	No. 6 solder lugs.
78	2	No. 4 solder lugs.
79	4	No. 8 solder lugs.
80	1	Speaker.
81	2	Shock mount slide assembly.
82	1	Cabinet welding assembly.
83	1	Terminal board assembly (long).
84	1	Terminal board assembly (short).
85	1	Plug and cable assembly.
85A	1	Cable 2, not shown.
85B	1	Cable 1, not shown.
85C	1	Cable 3, not shown.
85D	1	Cable 4, not shown.
85E	1	Cable 5, not shown.
85F	1	Cable 6, not shown.
85G	1	Cable 7, not shown.
85H	1	Control socket and cable assembly, not shown.
86	2	Flat insulating washer.
87	2	Insulating shoulder washer.
87A	5	Cork washers.
88	2	Toggle switch, SPST.

Item	No. req	Description	Item	No. req	Description
89	1	Toggle switch, DPDT.	109	12	8-32 x 1/4 inch long, binding head machine screw, brass, nickel-plated.
90	1	Switch, 2-pole, 6-position.	110	2	8-32 x 5/16 inch long, binding head machine screw, brass, nickel-plated.
91	1	Toggle switch, DPDT.	111	7	8-32 x 3/8 inch long, binding head machine screw, brass, nickel-plated.
92	1	Toggle switch, SPDT.	112	24	No. 8 internal tooth lockwasher, brass, nickel-plated.
93	12	4-36 x 3/8 inch long, flathead machine screw, brass nickel-plated.	113	2	No. 8 flat washer, brass, nickel-plated.
94	10	4-36 x 3/8 inch long, binding head machine screw, brass, nickel-plated.	114	10	8-32 hex. nuts, brass, nickel-plated.
94A	4	4-36 x 1/4 inch long, roundhead machine screw, brass, nickel-plated.	115	2	10-32 x 1/2 inch long, binding head machine screw, brass, nickel-plated.
95	1	4-36 x 1/2 inch long, roundhead machine screw, brass, nickel-plated.	116	2	10-32 x 1/2 inch long, roundhead machine screw, brass, nickel-plated.
96	3	4-36 x 1/2 inch long, binding head machine screw, brass, nickel-plated.	117	2	No. 10 split lockwasher, brass, nickel-plated.
97	3	4-36 x 5/8 inch long, binding head machine screw, brass, nickel-plated.	118	2	No. 10 internal tooth lockwasher, brass, nickel-plated.
98	30	No. 4 internal tooth lockwashers, brass, nickel-plated.	119	2	1/4 inch -20 hex. nuts, brass, nickel-plated.
99	17	4-36 hex. nut, brass, nickel-plated.	120	2	1/4 inch internal tooth lockwasher, brass, nickel-plated.
100	4	4-36 hex. nut, 1/16-inch thick x 3/16-inch across, flat.	121	4	No. 4 Kant Link lockwashers, phosphor-bronze.
101	17	6-32 x 1/4 inch long, binding head machine screw, brass, nickel-plated.	122	1	Dial knob.
102	2	6-32 x 1/4 inch long, roundhead machine screw, brass, nickel-plated.	123	1	Dial knob.
103	89	6-32 x 5/16 inch long, binding head machine screw, brass, nickel-plated.	124	1	Dial knob.
104	4	6-32 x 3/8 inch long, binding head machine screw, brass, nickel-plated.	125	1	Dial knob.
105	1	6-32 x 3/8 inch long, fillister head machine screw, brass, nickel-plated.	126	3	Grounding spring.
105A	1	6-32 x 1/4 inch long, fillister head machine screw, brass, nickel-plated.	127	2	Flat washer, steel, cadmium-plated, 5/8 inch outside diameter.
106	4	6-32 x 1/2 inch long, binding head machine screw, brass, nickel-plated.	128	5	Flat washer, brass, nickel-plated, 5/8 inch outside diameter, 5/32 inch inside diameter x 0.010.
107	175	No. 6 internal tooth lockwashers, brass, nickel-plated.	129	2	Flat washer, brass, nickel-plated, 5/8 inch outside diameter, 11/16 inch inside diameter x 0.010.
108	120	6-32 hex. nuts, brass, nickel-plated.			



Figure 36. Parts identification, front panel, Receiver R-19(*)/TRC-1.

4 REQD PER SOCKET

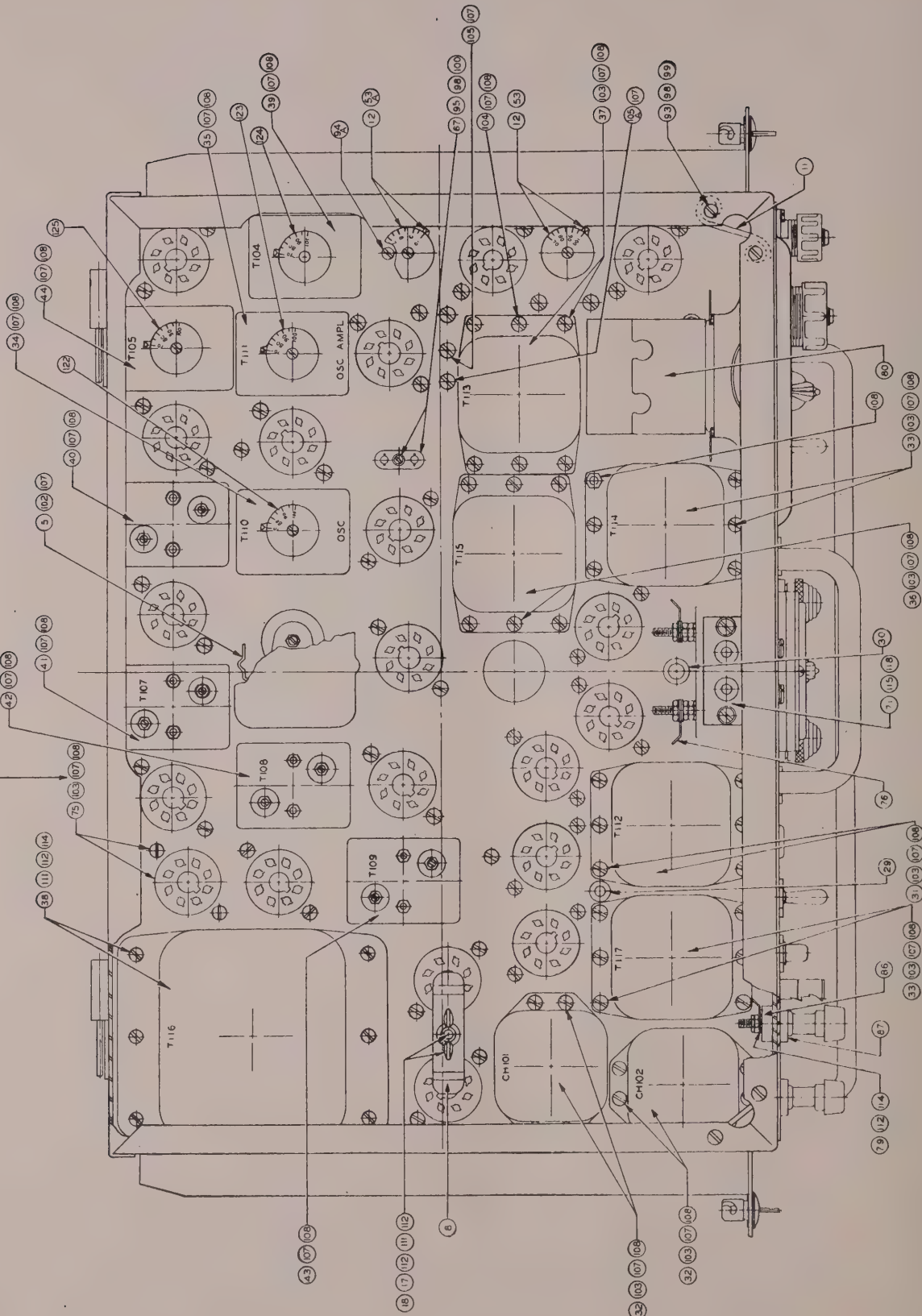
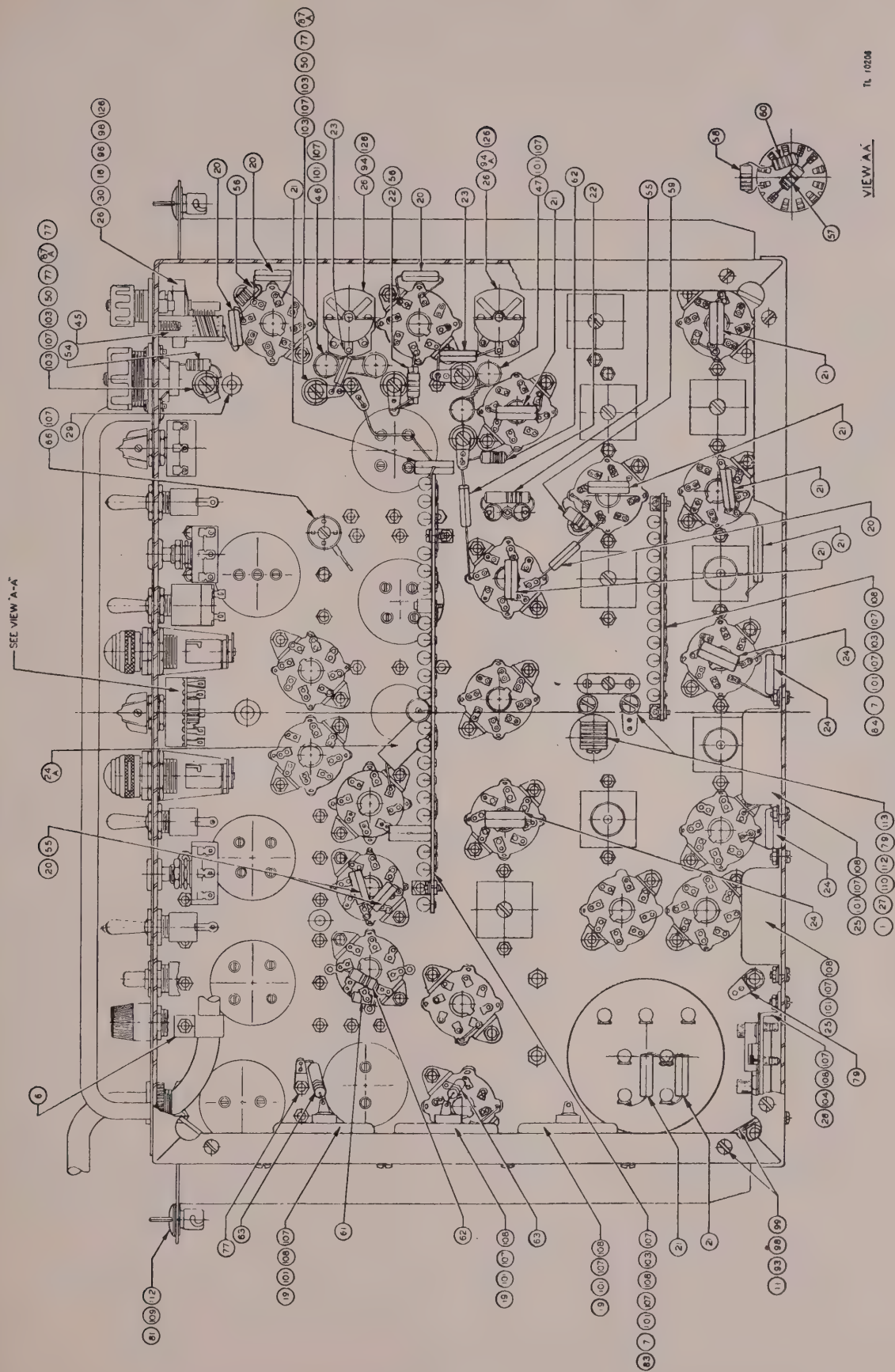


Figure 37. Parts identification, top of chassis, Receiver R-19(*)/TRC-1.



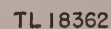
TL 10204

VIEW A-A

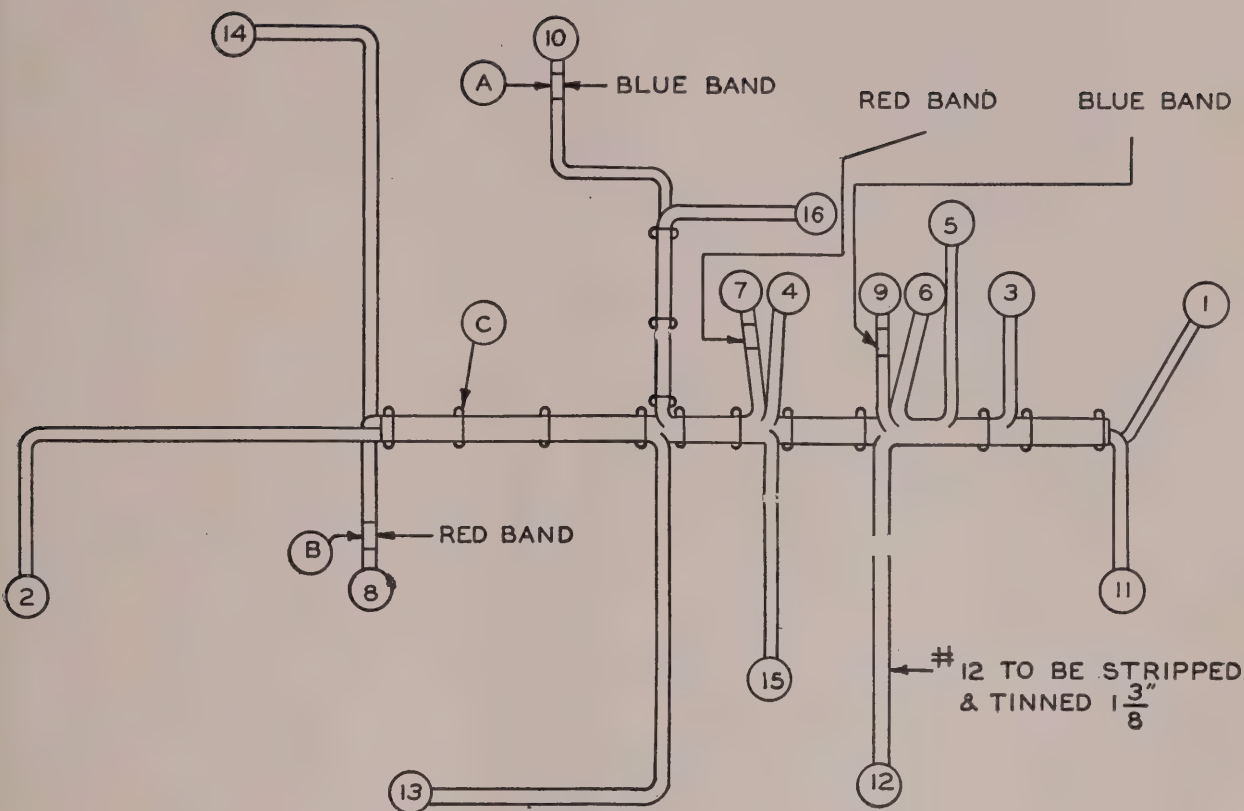
Figure 38. Parts identification, bottom of chassis, Receiver R-19(*)/TRC-1.

Diagram illustrating a water supply system layout with numbered points (1 through 7) and colored bands (RED BAND, BLUE BAND, YELLOW BAND) indicating specific sections or components.

CUT WIRES TO LENGTH JUST BELOW CIRCLES. STRIP 3/8" & TIN.
CABLE TO BE DIPPED IN FUNGUS LACQUER.



72



REQ'D	START	COLOR	WIRE TYPE	END
16"	1	WHITE-GREEN	#22 STRANDED-GLASS-VINYLTE	2
13"	3	WHITE-RED	" " " "	4
12"	5	WHITE-ORANGE	" " " "	6
13"	7	WHITE-RED	" " " "	8
15"	9	WHITE-ORANGE	" " " "	10
12"	11	WHITE-BLACK	" " " "	12
16"	13	WHITE-YELLOW	" " " "	14
12"	15	WHITE-BLUE	" " " "	16
1 1/2"	A	BLUE	2MM SATURATED SLEEVING	-
1 1/2"	B	RED	" " " "	-
30"	C	WHITE	#6 LACING TWINE	-

NOTE:

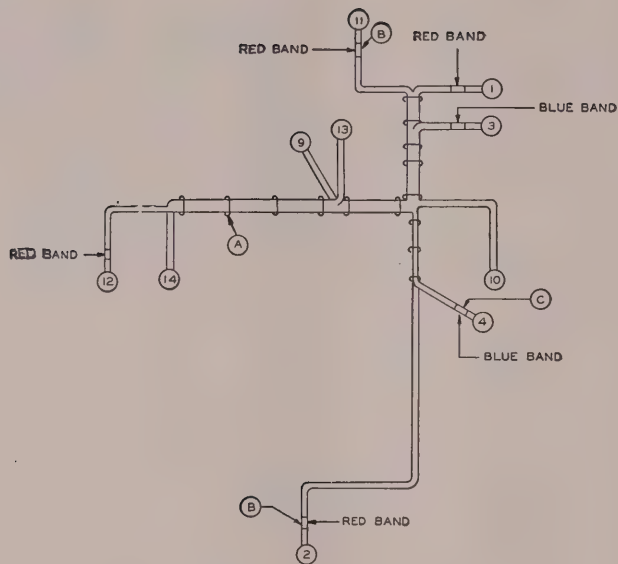
CUT WIRES TO LENGTH JUST BELOW CIRCLES. STRIP 3/8" AND TIN.

SEE NOTE AT #12.

CABLE TO BE DIPPED IN FUNGUS LACQUER.

TL18368

Figure 40. Cable construction No. 2.



REQ'D	ITEM	COLOR	WIRE TYPE	END
18"	1	WHITE-BLUE	#22 STRANDED-GLASS-VINYLLITE	2
13"	3	WHITE-BLUE	" " " "	4
14"	9	WHITE-ORANGE	" " " "	10
16"	11	WHITE-RED	" " " "	12
13"	13	WHITE-ORANGE	" " " "	14
3 FT	A	WHITE	#6 LACING TWINE	-
1 1/2"	B	RED	2 MM SATURATED SLEEVING	-
1"	C	BLUE	" " " "	-

NOTE:
 CUT WIRES TO LENGTH JUST BELOW CIRCLES. STRIP BACK 3/8"
 & TIN.
 CABLE TO BE DIPPED IN FUNGUS LACQUER.

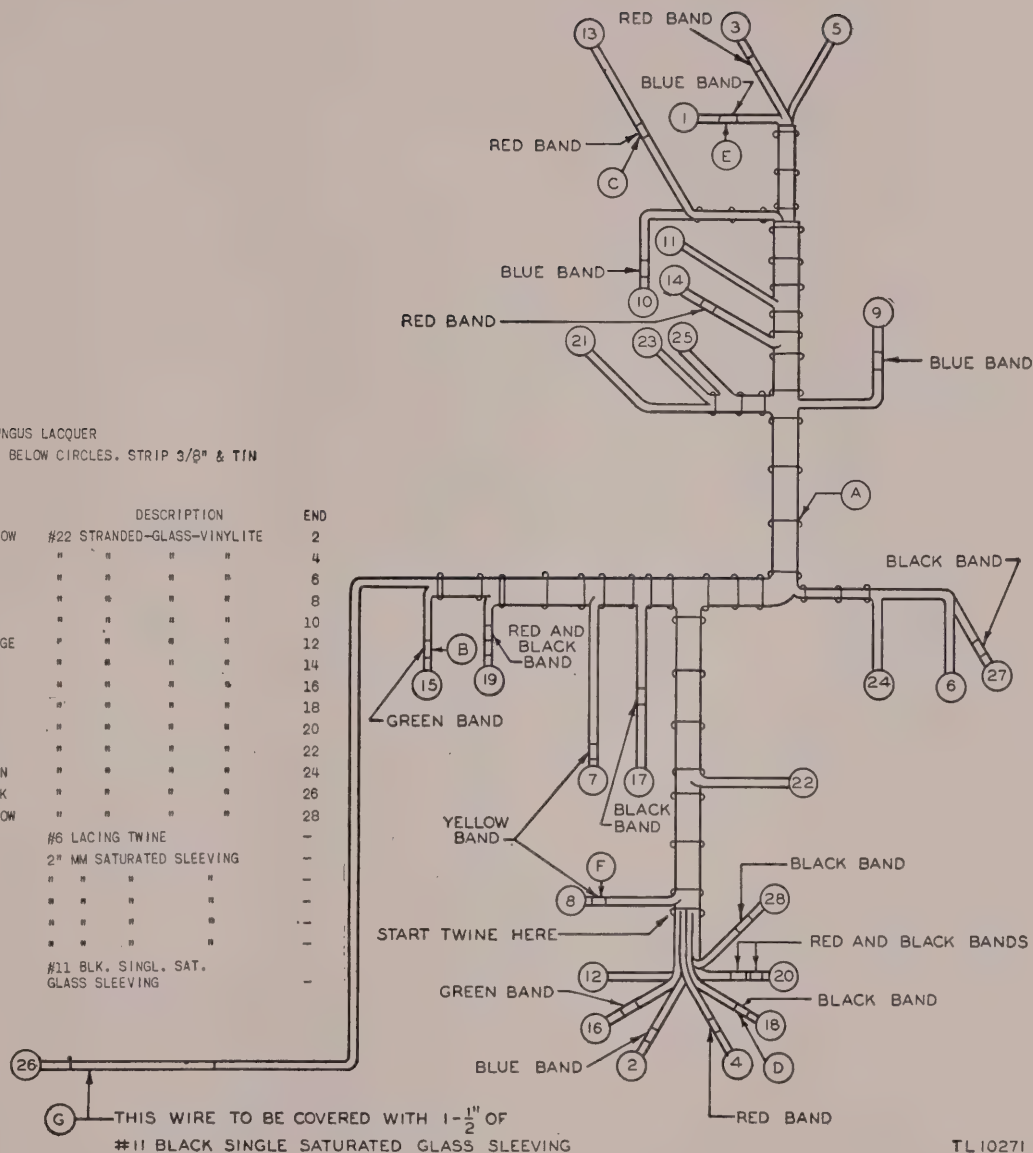
TL1027b

Figure 41. Cable construction.

NOTE:

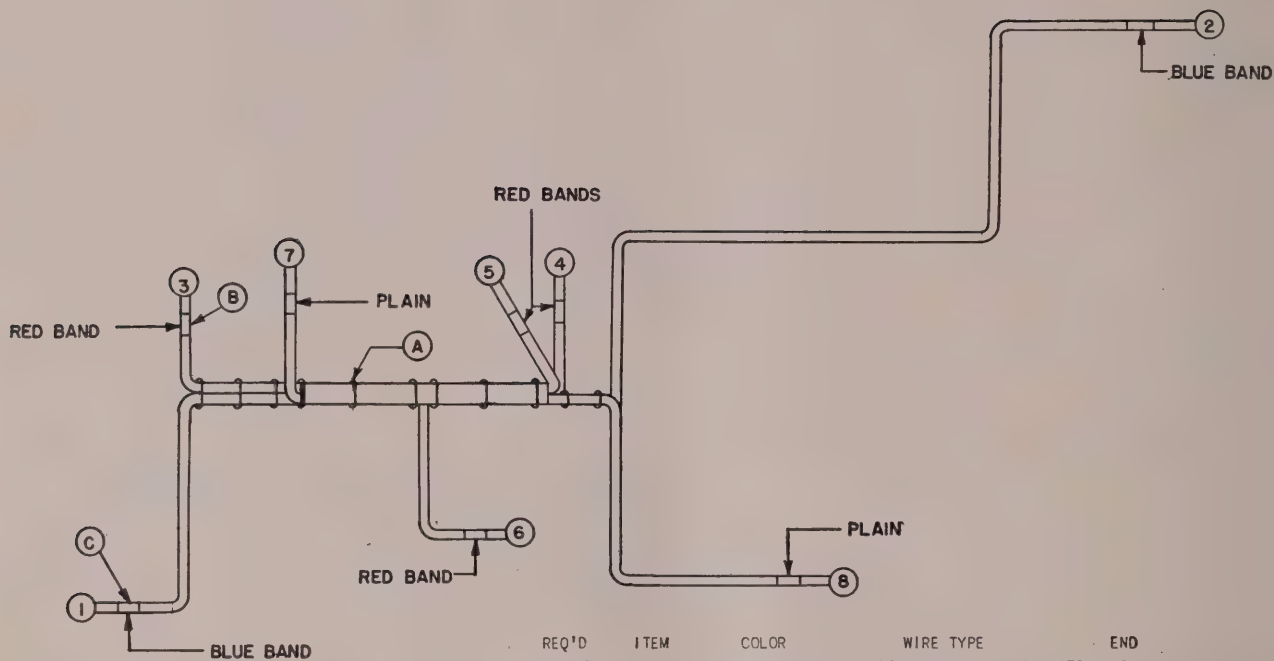
CABLE TO BE DIPPED IN FUNGUS LACQUER
CUT WIRES TO LENGTH JUST BELOW CIRCLES. STRIP $\frac{3}{8}$ " & TIN

REQ'D	START	COLOR	DESCRIPTION	END
19"	1	WHITE-YELLOW	#22 STRANDED-GLASS-VINYLLITE	2
19"	3	" "	" " " "	4
15"	5	" "	" " " "	6
14"	7	" "	" " " "	8
13"	9	WHITE-RED	" " " "	10
13"	11	WHITE-ORANGE	" " " "	12
12"	13	" "	" " " "	14
15"	15	" "	" " " "	16
14"	17	" "	" " " "	18
14"	19	" "	" " " "	20
14"	21	WHITE-BLUE	" " " "	22
13"	23	WHITE-GREEN	" " " "	24
21"	25	WHITE-BLACK	" " " "	26
14"	27	WHITE-YELLOW	" " " "	28
7'	A	WHITE	#6 LACING TWINE	-
1"	B	GREEN	2" MM SATURATED SLEEVING	-
2"	C	RED	" " " "	-
2"	D	BLACK	" " " "	-
1 1/2"	E	BLUE	" " " "	-
1"	F	YELLOW	" " " "	-
1 1/2"	G	BLACK	#11 BLK. SINGL. SAT. GLASS SLEEVING	-



TL 10271

Figure 42. Cable construction No. 4.



REQ'D	ITEM	COLOR	WIRE TYPE	END
22"	1	WHITE-RED	#22 STRANDED-GLASS-VINYLLITE	2
13"	2	WHITE-ORANGE	" " " "	4
11"	5	WHITE-ORANGE	" " " "	6
14"	7	WHITE-ORANGE	" " " "	8
25"	A	WHITE	#6 LACING TWINE	-
1 1/2"	B	RED	2 MM SATURATED SLEEVING	-
1"	C	BLUE	" " " "	-

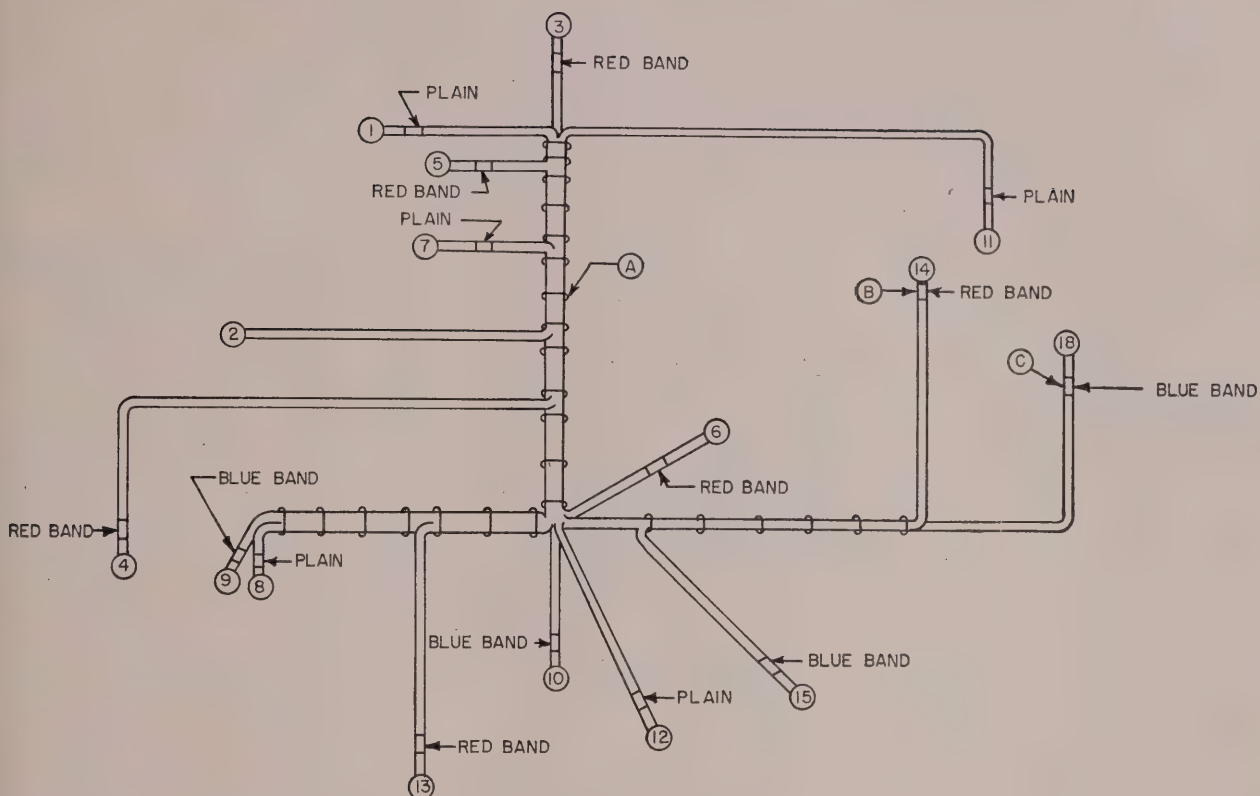
NOTE:

CUT WIRES TO LENGTH JUST BELOW CIRCLES. STRIP BACK 3/8" & TIN.

CABLE TO BE DIPPED IN FUNGUS LACQUER.

TL 10252

Figure 43. Cable construction No. 5.



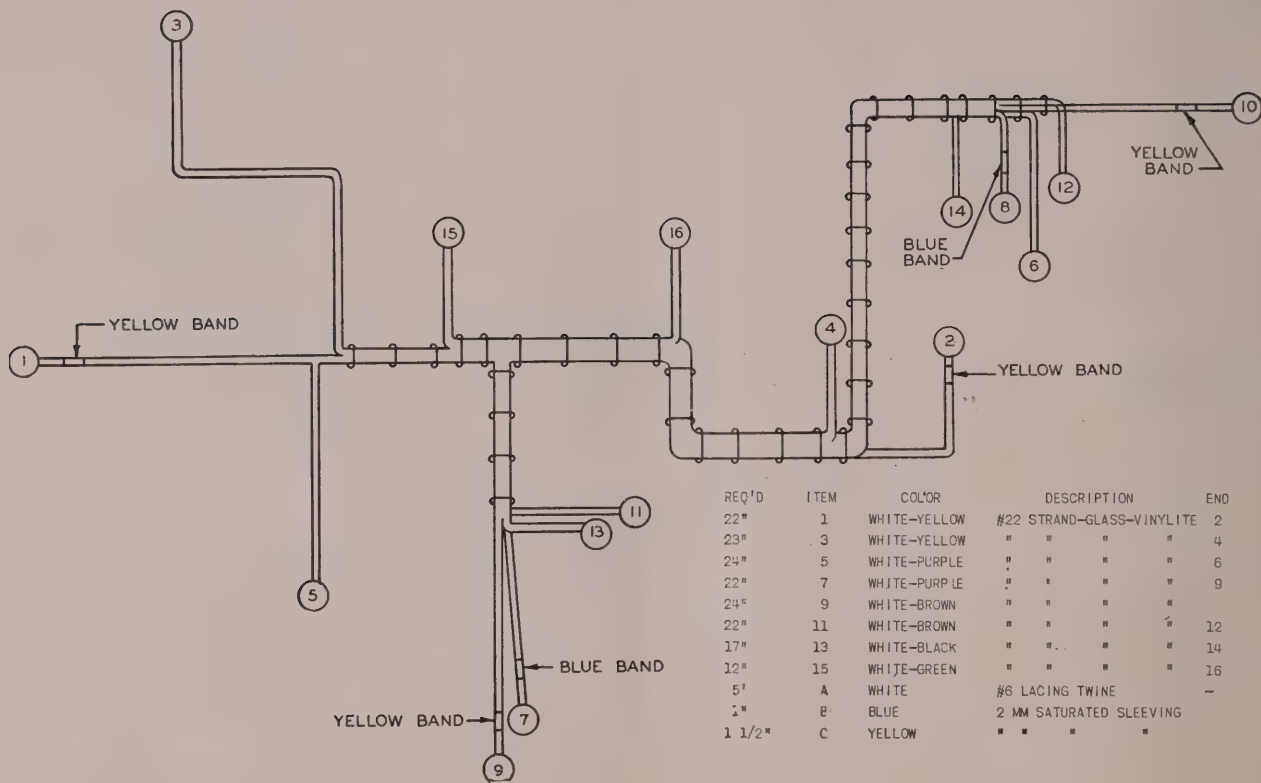
NOTE:

COMPLETED CABLE TO BE DIPPED IN FUNGUS LACQUER.

REQ'D	START	COLOR	DESCRIPTION	END
12"	1	WHITE-RED	#22 STRANDED-GLASS-VINYLLITE	2
16"	3	" "	" " " "	4
13"	5	WHITE-BROWN	" " " "	6
14"	7	" "	" " " "	8
11"	9	" "	" " " "	10
18"	11	WHITE-GREEN	" " " "	12
14"	13	" "	" " " "	14
15"	15	" "	" " " "	16
4 FT	A	WHITE	#6 LACING TWINE	-
2 1/2"	B	RED	2 MM SATURATED SLEEVING	-
1 1/2"	C	BLUE	" " " "	-

TL10249

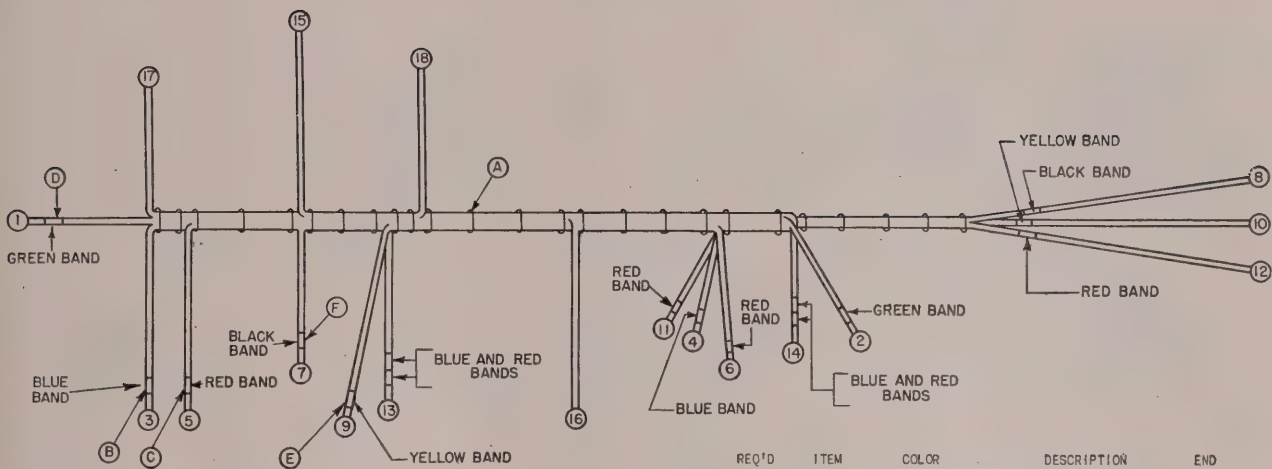
Figure 44. Cable construction No. 6.



CABLE TO BE DIPPED IN FUNGUS LACQUER.
CUT WIRE SO LENGTH JUST BELOW CIRCLES. STRIP BACK 3/8"
& TIN.

TL 18332

Figure 45. Cable construction No. 7.

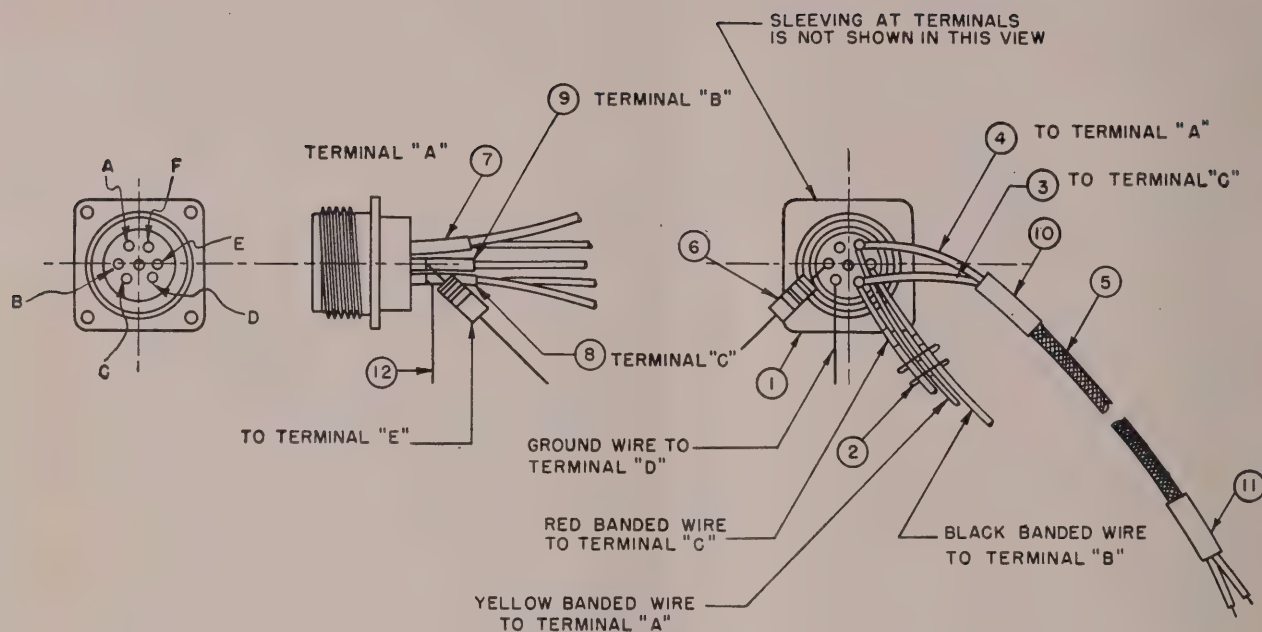


NOTE:
 CUT WIRES TO LENGTH JUST BELOW CIRCLE STRIP 3/8" AND TIN.
 CABLES TO BE DIPPED IN FUNGUS LACQUER.

REQ'D	ITEM	COLOR	DESCRIPTION	END
20"	1	WHITE-BROWN	#22 STRAND-GLASS-VINYLITE	2
18"	3	" "	" " " "	4
18"	5	" "	" " " "	6
20"	7	" "	" " " "	8
20"	9	" "	" " " "	10
18"	11	" "	" " " "	12
18"	13	" "	" " " "	14
18"	15	WHITE-BLACK	" " " "	16
16"	17	WHITE-PURPLE	" " " "	18
4'	A	WHITE	#6 LACING TWINE	-
1 1/2"	B	BLUE	2 MM SATURATED TUBING	-
2"	C	RED	" " " "	-
1"	D	GREEN	" " " "	-
1"	E	YELLOW	" " " "	-
1"	F	BLACK	" " " "	-

TL10257

Figure 46. Cable construction No. 8.



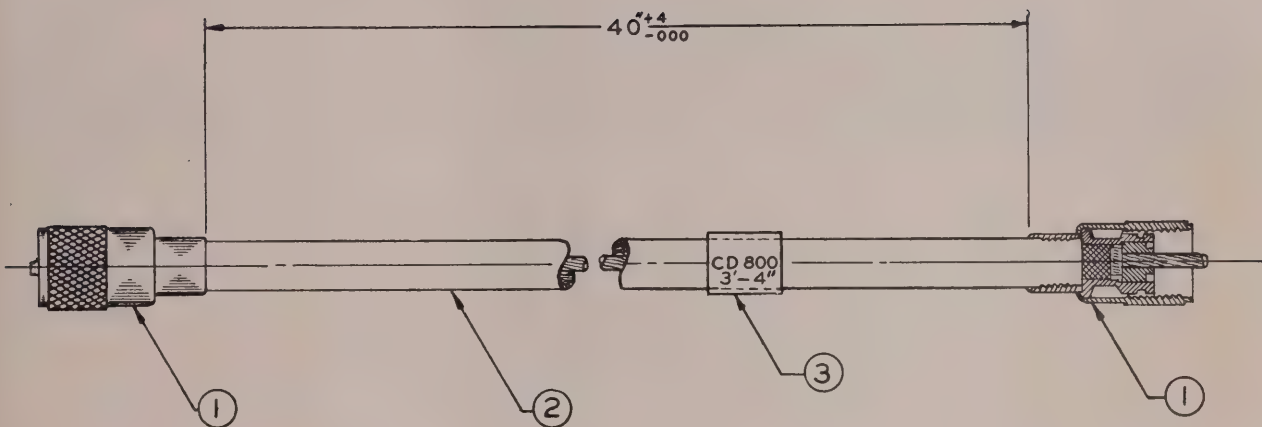
REQ'D	ITEM	DESCRIPTION
1	1	RECEPTACLE, CONTROL (FEMALE)
1	2	CABLE #8
19"	3	#22 STRAND, GLASS-VINYLLITE (WHITE-BROWN)
19"	4	#22 STRAND, GLASS-VINYLLITE (WHITE-BROWN)
16"	5	BRAID (COPPER TINNED) 1/4" WIDE
1	6	FIXED RESISTOR 1000 OHM 1/2W $\pm$ 10%
1/2"	7	SATURATED SLEEVING #6 (BLACK)
1/2"	8	SATURATED SLEEVING #8 (BLACK)
1/2"	9	SATURATED SLEEVING #12 (BLACK)
1-1/2"	11	SATURATED SLEEVING #7 (BLACK)
1-3/8"	12	BARE COPPER WIRE, TINNED

NOTE:

THIS ASSEMBLY IS NOT TO BE A STOCKED ITEM DUE TO BREAKAGE.

TL 18377

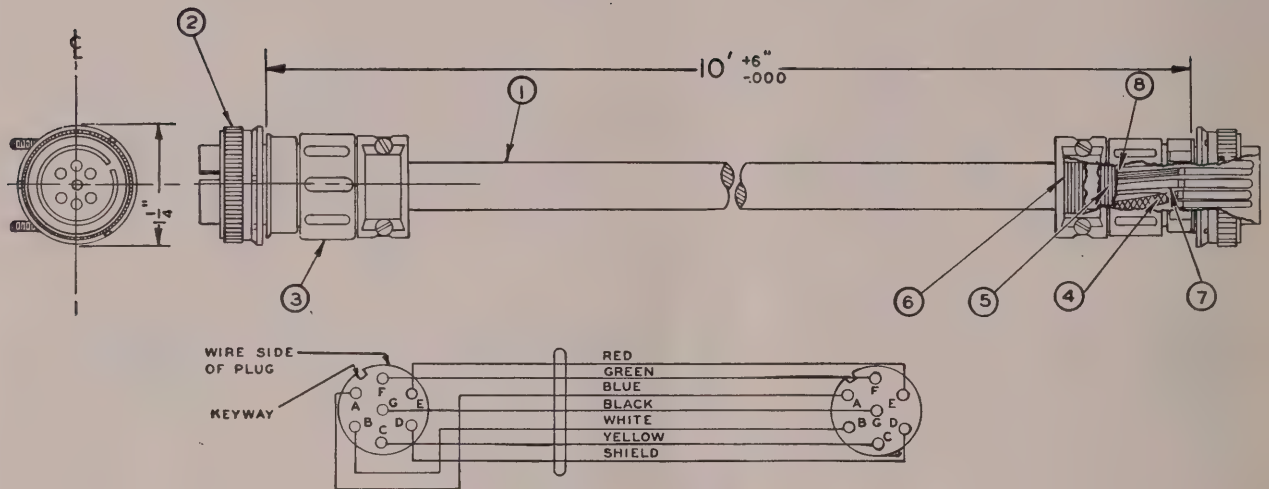
Figure 47. Control socket and cable assembly.



	REQ'D	AMPHENOL NO.	ITEM	DESCRIPTION
AMPHENOL # 20-90	1	-	3	MARKER
	1	RG-8U	2	CABLE
	2	PL-259	1	CONNECTOR ASSEMBLY

TL 10340

Figure 48. Cord assembly, antenna connector.

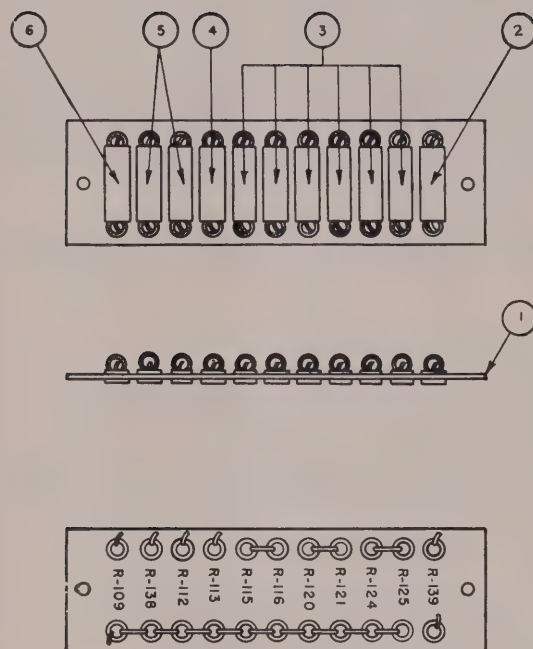


NOTE -- ITEM ⑧ WRAPPED AROUND CONDUCTORS.
SHIELD ROLLED BACK OVER TAPE & ITEM ⑤
WRAPPED AROUND GROUND WIRE (ITEM ④)
AND SOLDERED SECURELY. ITEM ⑥ COVERS
SOLDERED AREA.

REQ'D	ITEM	DESCRIPTION
10'3"	1	6 COND. - SHIELDED #18 CABLE
2	2	CONNECTOR AMPHENOL-AN-3106-16 S-1P
2	3	CLAMP AMPHENOL 3057-8
2"	4	#18 COTTON COVERED WIRE
14"	5	TINNED COPPER WIRE
2-1/4"	6	TUBING, 11 M.M.
3/4"	7	TUBING, 3 M.M.
4"	8	3/16" FRICTION TAPE

TL 10335

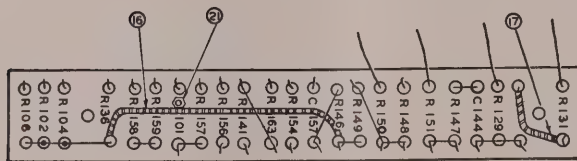
Figure 49. Cord CX-104.



REQ'D	ITEM	TITLE			
1	1	BOARD & EYELET ASSY.			
11	2	RESISTOR, CARBON			
6	3	"	"	15 OHM 1W ±10%	
1	4	"	"	50,000 " " ±10%	
2	5	"	"	10,000 " " ±10%	
1	6	"	"	100,000 " " ±10%	
		"	"	75,000 " " ±10%	

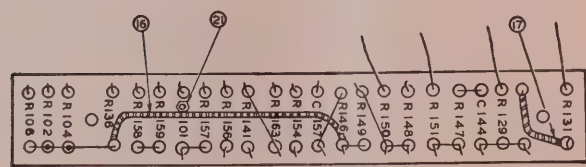
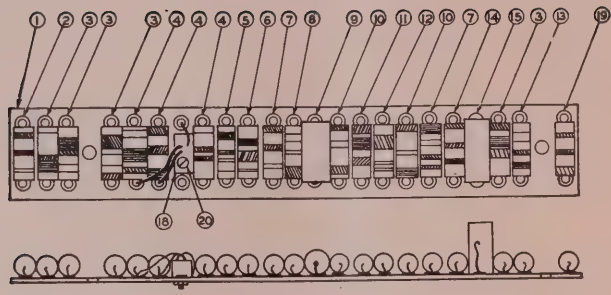
TL 18316

Figure 50. Resistor board assembly.



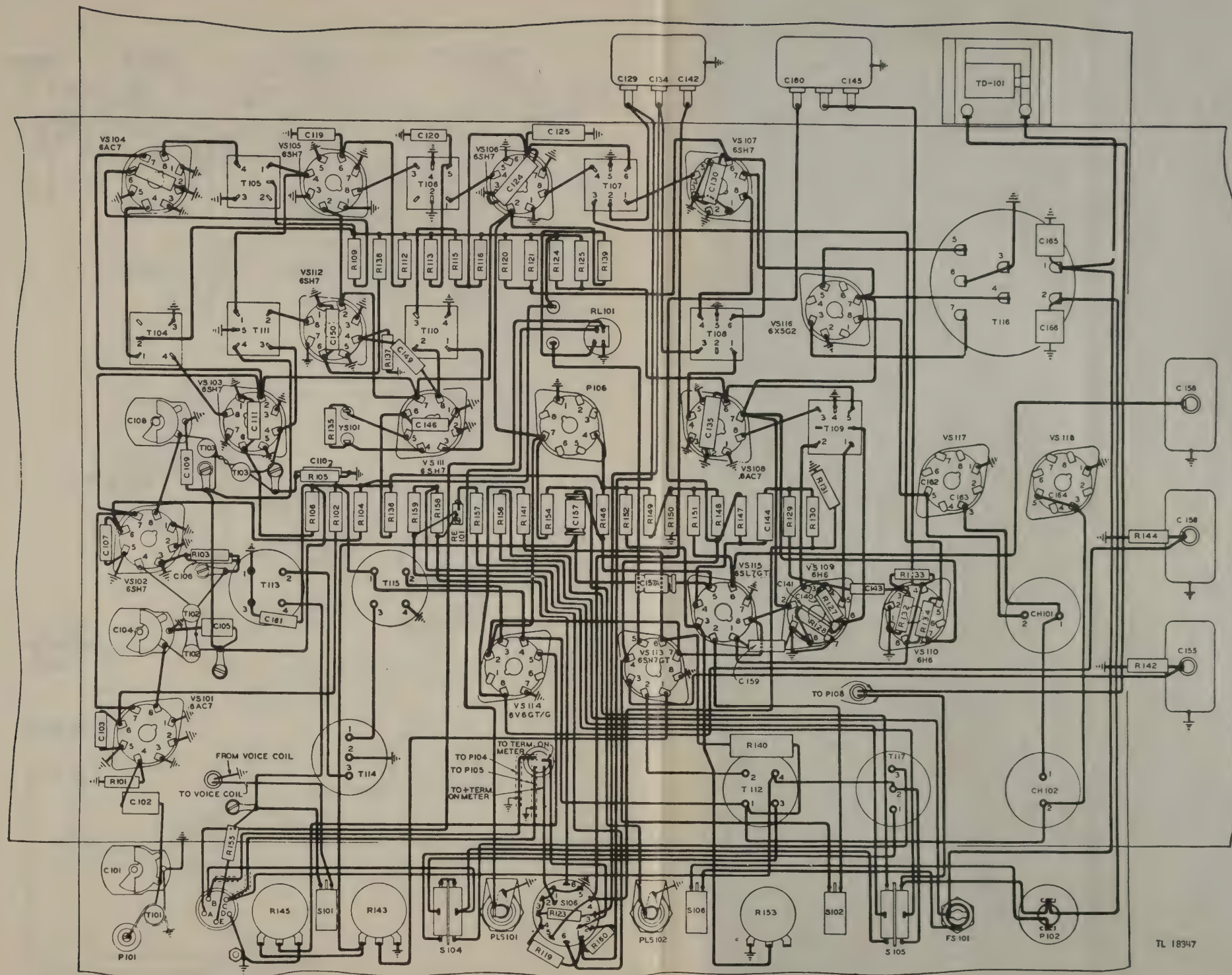
TL10263

84



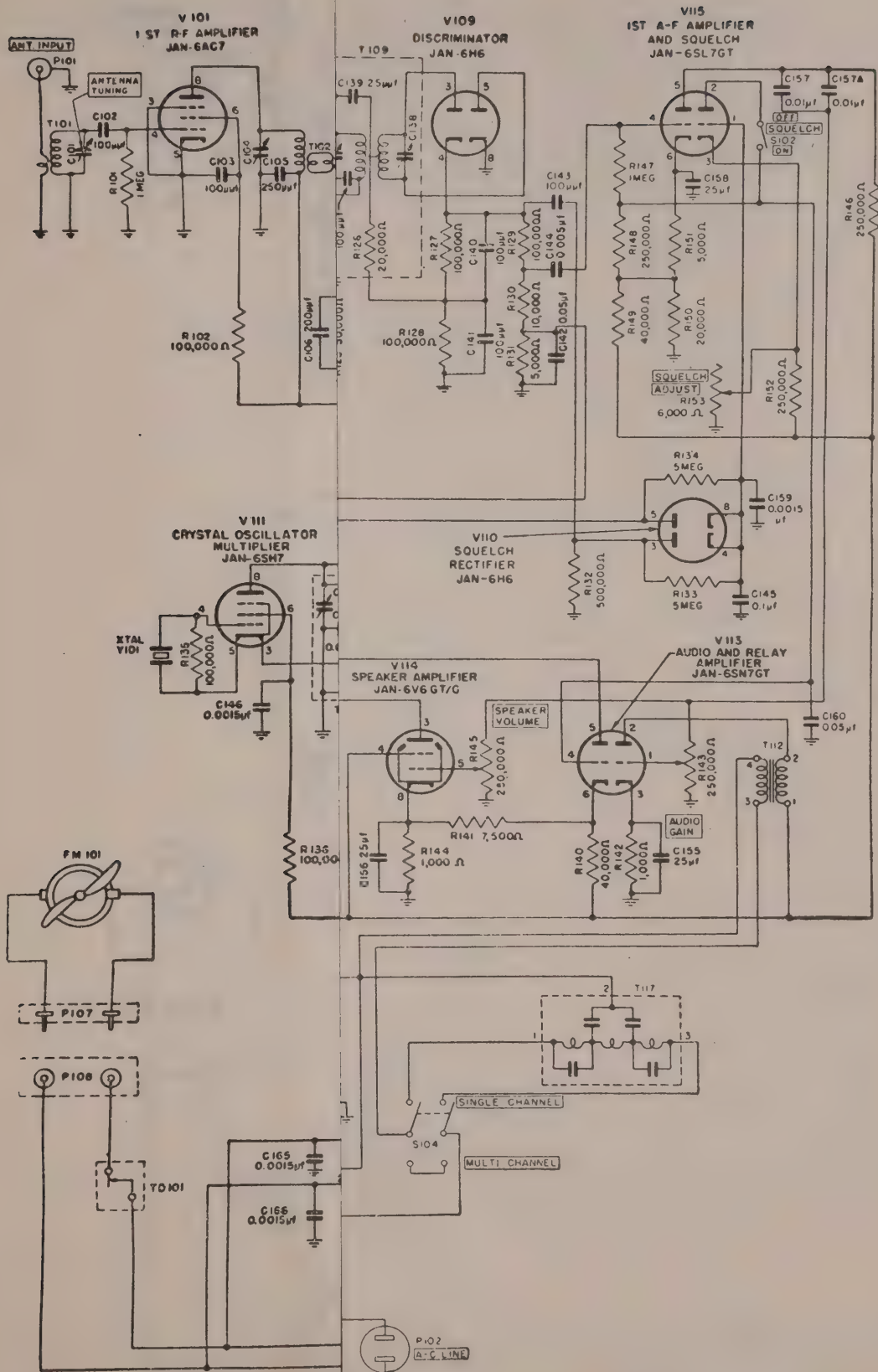
REQ	ITEM	DESCRIPTION	
1	1	TERMINAL BOARD	
1	2	FIXED RES. 500,000 OHM 1W ±10%	
4	3	FIXED RES. 100,000 OHM 1W ±10%	
3	4	FIXED RES. 3,000 OHM 1W ±10%	
1	5	FIXED RES. 850,000 OHM 1W ±5%	
1	6	FIXED RES. 7,500 OHM 1W ±10%	
2	7	FIXED RES. 2,000 OHM 1W ±10%	
1	8	FIXED RES. 15 OHM 1W ±10%	
1	9	FIXED PAPER .02 MF 600V ±20%	
2	10	FIXED RES. 250,000 OHM 1W ±10%	
1	11	FIXED RES. 40,000 OHM 1W ±10%	
1	12	FIXED RES. 20,000 OHM 1W ±10%	
1	13	FIXED RES. 10,000 OHM 1W ±10%	
1	14	FIXED RES. 1 MEG 1W ±10%	
1	15	FIXED CAP .005 MF 1000V ±10%	
5 1/2"	16	WHITE & RED	
2 1/2"	17	WHITE & GREEN	
1	18	METER RECTIFIER	
1	19	FIXED RES. 5,000 OHM 1W ±10%	
1	20	F.H. MS - 2 - 56 X 1/2 B.N.P.	
1	21	HEX. NUT 2-56 - 3/16 X 3/64 B.N.P.	TL10263

Figure 51. Long terminal board assembly.



TL 18347

Figure 52. Wiring diagram, Radio Receiver R 19(*)/TRC.1.



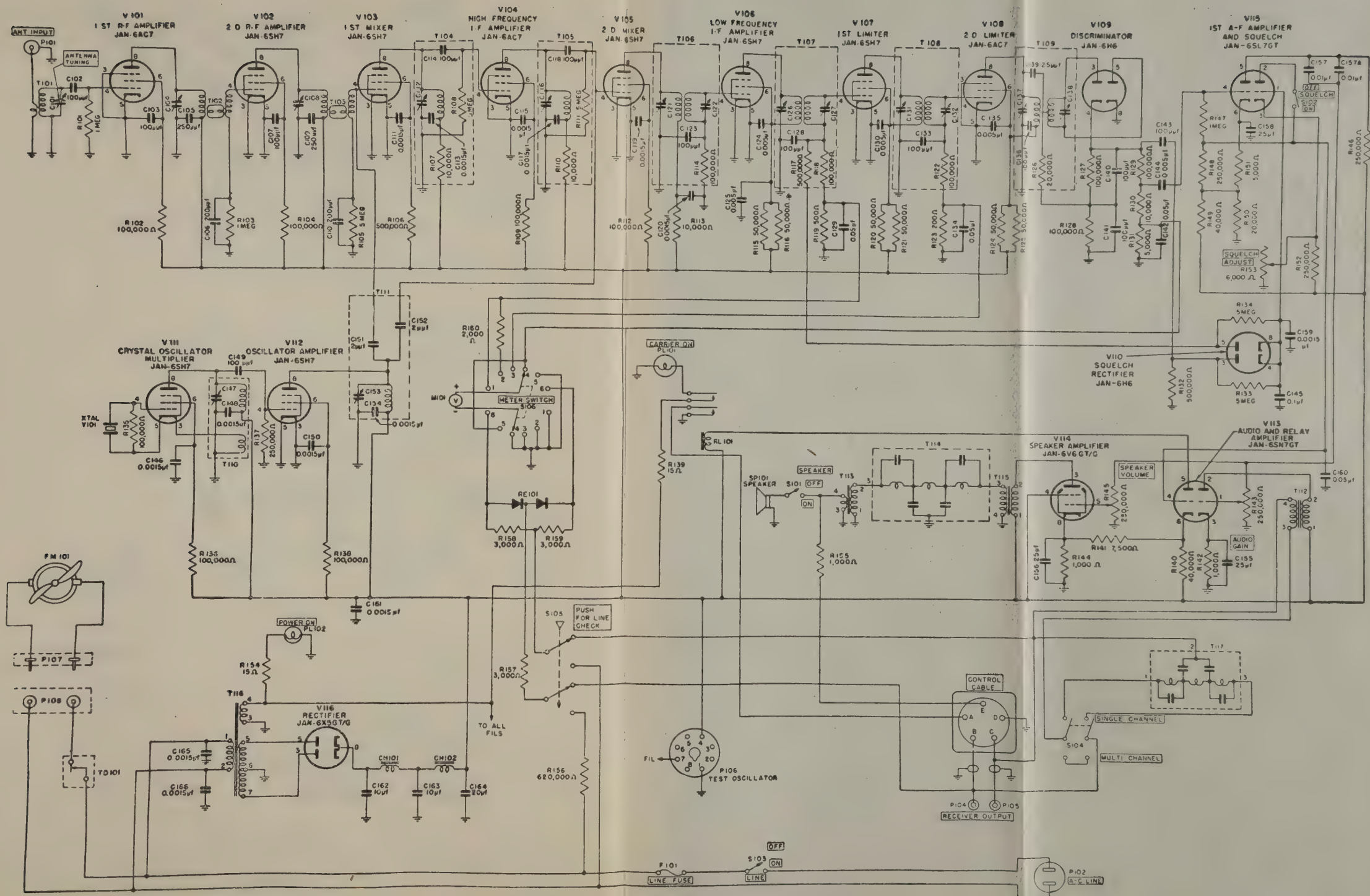
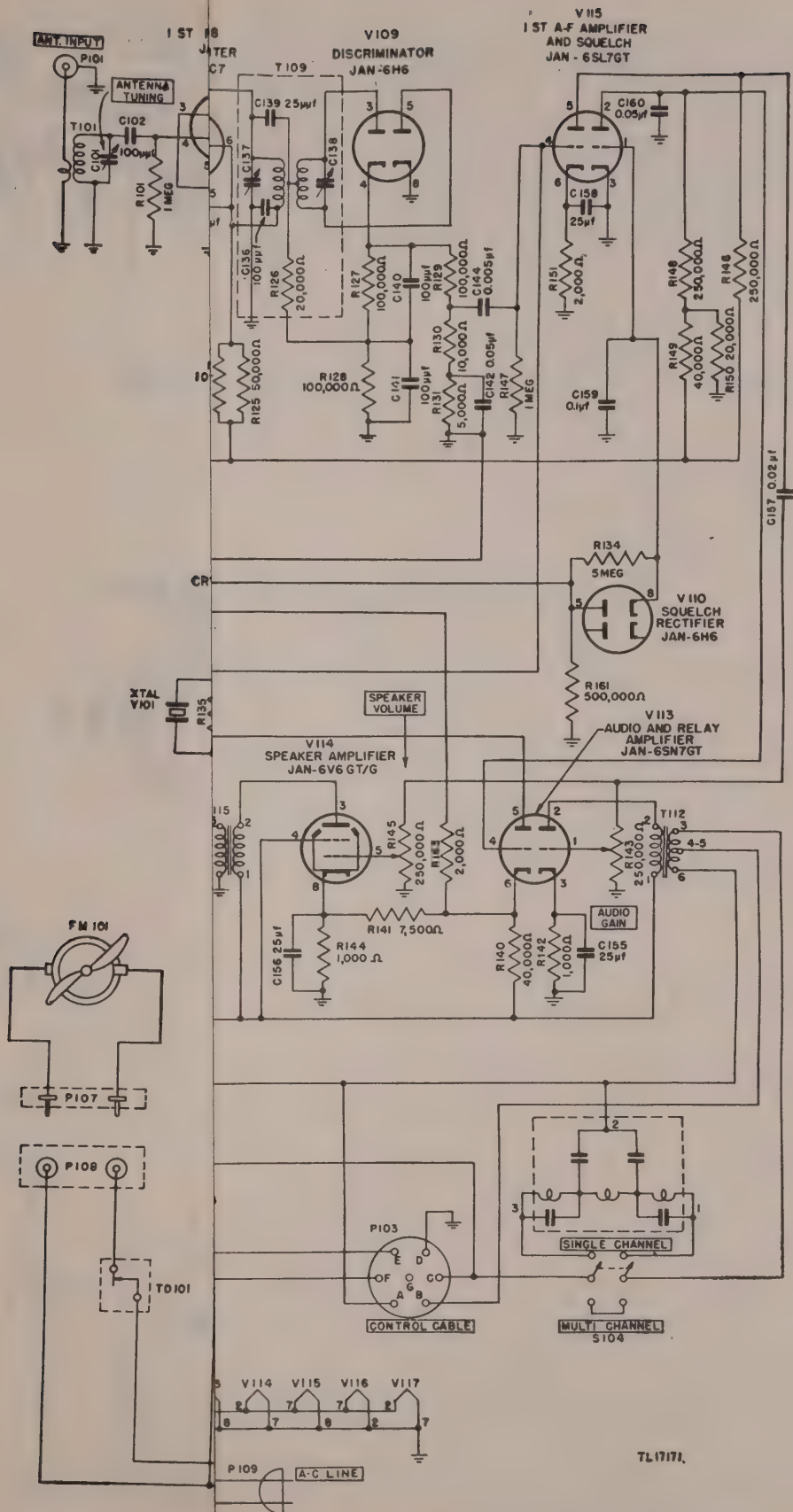


Figure 53. Schematic diagram, Radio Receiver R-19/TRC-1.



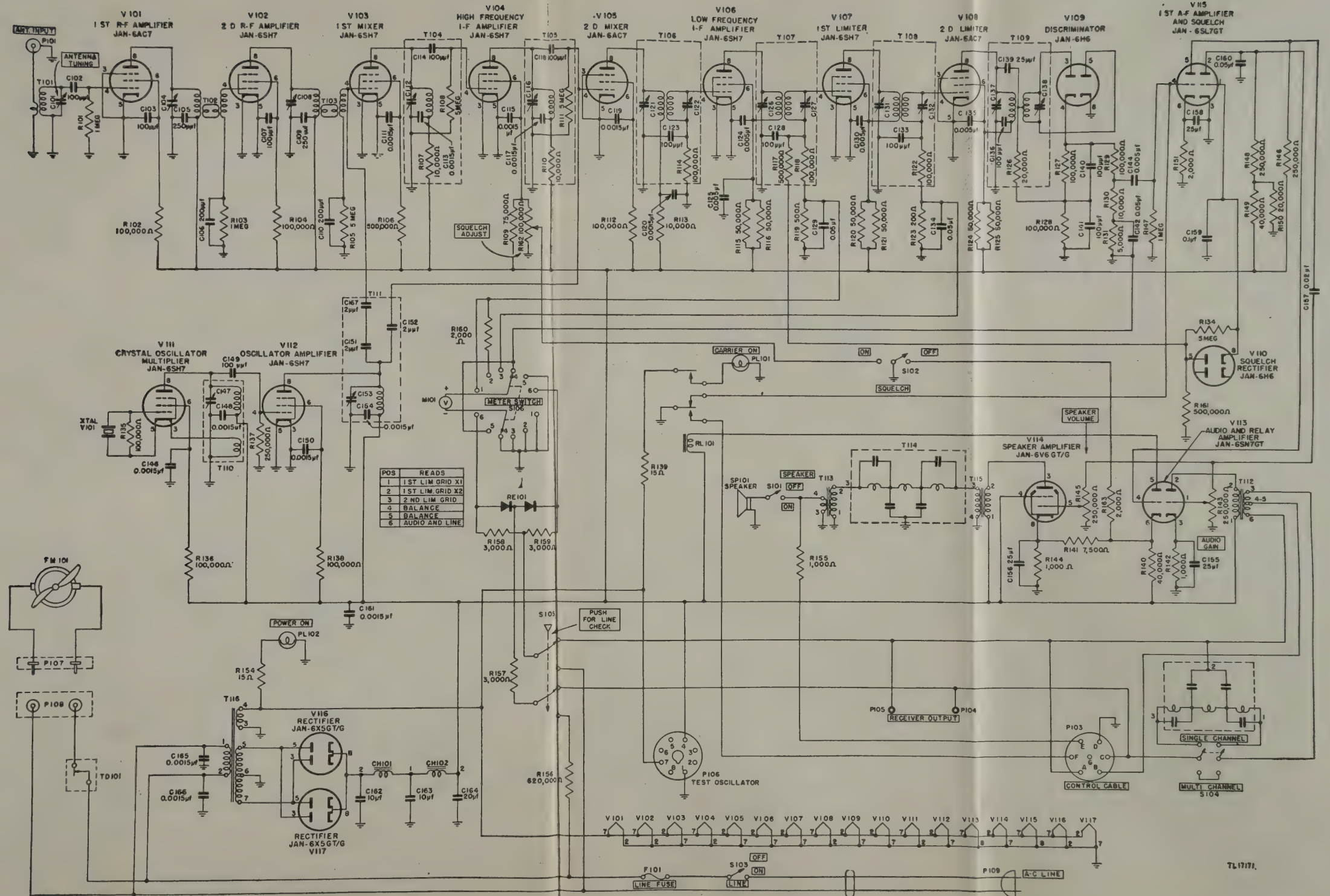
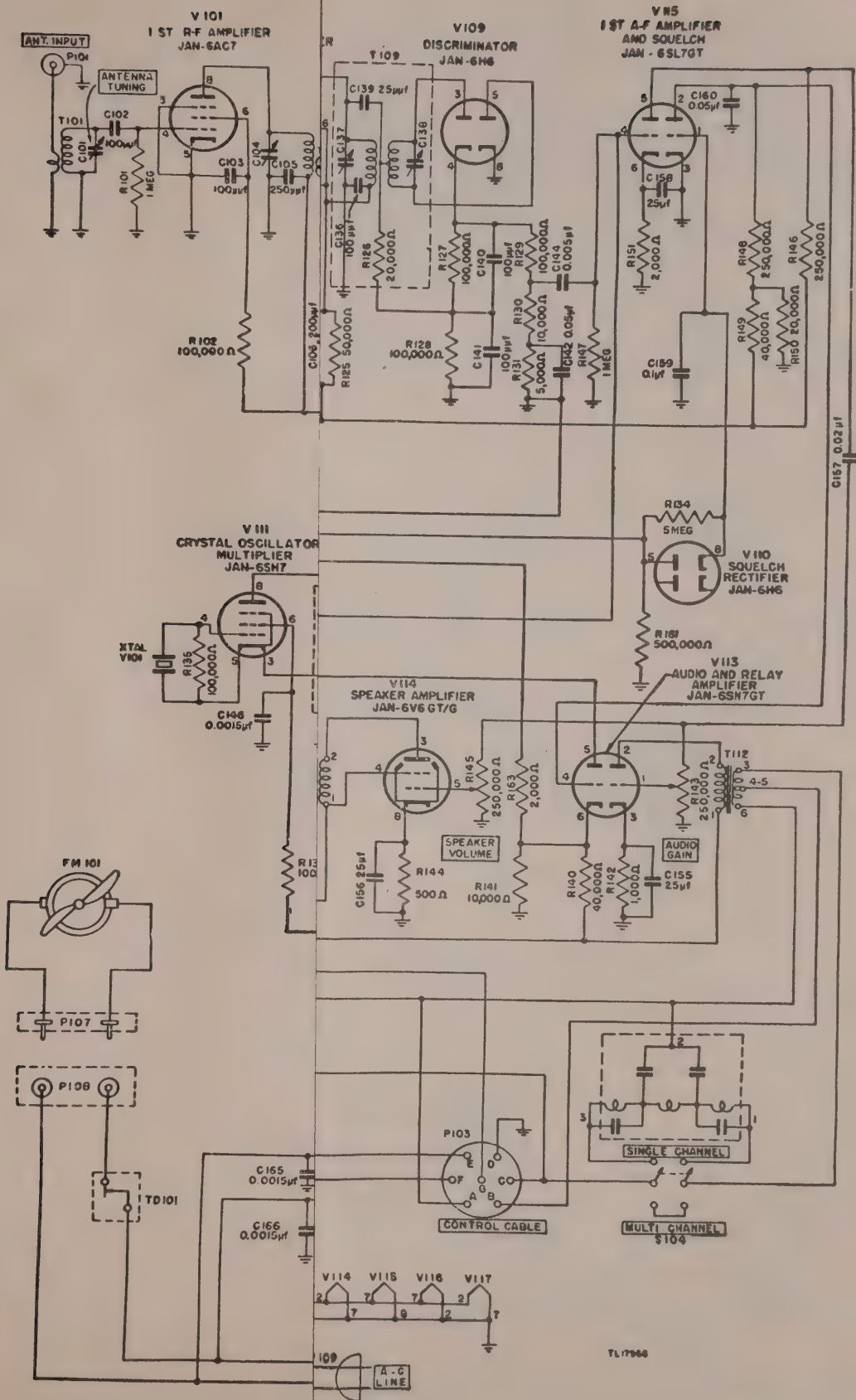


Figure 54. Schematic diagram, Radio Receiver R-19A/TRC-1.



TL7946

